PROJECT MANUAL

CLYDE TOWNSHIP MUNICIPAL CENTER
SITE & BUILDING IMPROVEMENTS

Project No. 16000800

3350 Vincent Road
North Street, MI 48049

Issued for Bidding
April 11, 2017

CHMP, INC.
5198 Territorial Road
Grand Blanc, Michigan 48439
810-695-5910

April 11, 2017

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CHMP, INC.
architecture • engineering
planning • interior design
landscape architecture

5198 Territorial Road • Grand Blanc, Michigan 48439 • 810-695-5910

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SECTION 001116 - INVITATION TO BID

Clyde Township (Owner) will receive and open sealed bids on Tuesday, May 2, 2017, from qualified General Contractors at Clyde Township located at 3350 Vincent Road, North Street, Michigan 48049, for General Construction to include work of all trades for the following:

1. Site and building improvements to the existing Township Hall.

Bidding documents will be available from the CHMP FTP Site for qualified General Contractors. Bidders must register with CHMP, INC. for access to the CHMP FTP Site. These documents will be available after 2:00 p.m. EDT on Tuesday, April 11, 2017. Contact the Architect (Gregory Mason, AIA) at 810-695-5910 or gmason@chmpinc.com for registration. Registration will place you on the bidder list for future notifications and addenda.

Additional sets of documents may be purchased on a non-refundable basis from the office of the Architect or at ARC Michigan/Gwyer Reprographics ((810) 695-9500; Michigan.grandblanc@e-arc.com) at cost of reproduction. Sub-contractors purchasing documents will be solely responsible for selection of drawing sheets and completeness of their bid and should notify CHMP of their intent to bid to insure receipt of addenda. Bids submitted which are not included on the pre-qualification list will not be considered. This CHMP bidder list will be used to issue any addenda or information relative to the bidding requirements.

No proposal may be withdrawn for a period of sixty (60) days after submission. Bids offering less than sixty (60) days for acceptance by the Owner from the date set for opening will be considered non-responsive and will be rejected.

The Owner reserves the right to reject any or all Bids and to waive irregularities or informalities as may be deemed in Owner's interest. It is the Owner's intent to award the project to the lowest responsive and responsible bidder for the total Bid for all of the construction work.

The successful bidder will be required to furnish performance, and labor and material bonds in an amount equal to one hundred percent (100%) of the contract amount. Surety on such bonds shall be a duly authorized company satisfactory to the Owner.

Clyde Township reserves the right to purchase building materials for the project for tax savings. The successful bidder and his/her subcontractors will be in agreement to cooperate with the Township in providing material purchase credits for Owner direct purchases.

A **mandatory** pre-bid meeting will be held at Clyde Township located at 3350 Vincent Road, North Street, Michigan 48049, Tuesday, April 18, at 10:00 a.m. E.D.T. followed by a "meet the local sub-contractors" meeting. A review of the bidding documents by the Architect will be provided along with an opportunity to raise questions. All bidders are required to attend and sub-contractors are encouraged to attend.

All inquiries should be directed to the office of the Architect: CHMP, INC., 5198 Territorial Road, Grand Blanc, Michigan 48439, Attention: Gregory N. Mason, A.I.A., E-mail – gmason@chmpinc.com, telephone (810) 695-5910, or fax (810) 695-0680. The last day for questions to be issued to the Architect is April 27, 2017, 5:00 p.m.

END OF SECTION 001116

SECTION 002113 - INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 RECEIPT AND OPENING OF BIDS

A. Clyde Township (herein called the “Owner”) invites Bid/Tenders for construction.

B. Bid/Tenders will be received at place and time indicated in Invitation to Bid.

C. Bid/Tenders will be publicly opened and read aloud immediately following receipt of the bids.

D. Sealed envelope containing Bid/Tender and address to: Clyde Township Municipal Center – Site & Building Improvements, 3350 Vincent Road, North Street, MI 48049.

1.2 METHODS OF BIDDING

A. Owner invites Bid/Tenders on General Construction work to be limited to trades associated with the Building and Site Improvements.

B. See Bid/Tender form for specific requirements regarding bids and cost breakdown.

C. Bidders must be pre-qualified in order to submit a bid on this project.

D. Proposals shall be a lump sum amount for the entire project and bidders must agree to the project schedule established for the project.

1.3 AVAILABILITY OF DOCUMENTS

A. Contract Documents may be examined after 2:00 p.m., Tuesday, April 11, 2017, at the following locations:

1. CHMP, Inc.
5198 Territorial Road
Grand Blanc, MI 48439
(810) 695-5910
(810) 695-0680 - fax

2. Clyde Township
3350 Vincent Road
North Street, MI 48049
(810) 985-7258
(810) 985-3065 – fax

3. McGraw-Hill/Kal Blue
914 E. Vine Street
Kalamazoo, MI 49001
(616) 698-1211
Email: john.grima@construction.com

4. Construction Association of Michigan
43636 Woodward Avenue
Bloomfield Hills, MI 48302
(248) 972-1000
(248) 972-1136 - fax

5. Builders Exchange
1240 E. Saginaw Street
Lansing, MI 48906
(517) 372-8930
(517) 372-5022 - fax

1.4 DOCUMENT DOWNLOAD

A. Bidding Documents will be available for download from the CHMP FTP Site to qualified General Contractors. Bidders must register with CHMP, INC. for access to the CHMP FTP Site. Contact Gregory Mason, AIA at (810) 695-5910 or gmason@chmpinc.com for registration. Bidder is solely responsible for selection of drawing sheets and completeness of bid. This site will be used for issuance of addenda and notifications.

B. The bidder will be obligated complete the project by the mandatory completion date stipulated under Section 011113 – "Summary of Work". **Contractor will be subject to liquidated damages in the amount of $350.00 per calendar day for each day the project has not been completed after the mandatory completion date**.

1.5 ADDITIONAL PURCHASE

A. Persons requiring documents other than as above may purchase them at reproduction costs from CHMP, INC., 5198 Territorial Road, Grand Blanc, MI 48439 or from Arc Michigan/Gwyer Reprographics, 8226 Embury Road, Grand Blanc, MI 48439. No refunds on purchased items. Bidder is solely responsible for selection of drawing sheets and completeness of his bid. Applicable sales tax will be charged on all purchases.

B. CHMP Reproduction Costs:

1. Drawings: Prints - 17 cents per square foot
2. Specifications: - 10 cents per printed face
3. Handling: - $10.00 plus mailing cost per order

C. Addenda if issued will be made available for purchase on the same cost basis, less handling charge. Note that it is the sole responsibility of the purchaser to determine if Addenda is issued and what, if any, part of each is of interest to the purchaser.

D. Pick-up of purchased documents may be made as previously noted for distribution to Bidders. Arrange in advance for pick-up, to permit time for preparation of the required documents.

1.6 PREPARATION OF BID/TENDER

A. Submit on forms furnished herein.

B. Fill out in ink or typewritten, without erasure, interlineation or changes.

C. Make Bid/Tender in name of principal and if co-partnership, give names of all parties. Give complete address. If Bid/Tenders are submitted by an agent, provide satisfactory evidence of agency authority.

D. Fill in all blank spaces for bid prices in both words and figures. Submit each Bid/Tender in sealed envelope. Indicate on outside of envelope, name of bidder, bidders address, and name of project for which bid is submitted. If forwarded by mail, enclose sealed envelope containing bid in another envelope addressed as indicated.

E. Bid/Tenders must be received prior to opening time. Note: Unit pricing will be permitted to be submitted by 5:00 p.m. on the day of the bid provided balance of Bid Tender is submitted with all requested pricing including alternates as reviewed by 2:00 p.m.

F. Provide listing of local sub-contractors and material supplier proposed for the project, if awarded.

1.7 WITHDRAWAL OR REVISION OF BID/TENDERS

A. Bid/Tenders may be withdrawn or revised prior to scheduled time for opening, under following terms:

1. Bidders may, without prejudice to himself, withdraw Bid/Tender after it has been deposited, provided request for such withdrawal is received in writing or by telegram, before time set for opening. Telephonic communications not acceptable. After opening, no Bid/Tender may be withdrawn for period indicated.

2. Bidder may modify his Bid/Tender by telegraphic communication at any time prior to scheduled time for opening, provided such telegraphic communication is received prior to opening, and, provided further, Owner is satisfied that written communication over signature of bidder was mailed prior to opening.

B. Do not reveal bid price in telegraphic communication. Provide addition, subtraction or modification so that final prices or terms will not be known until sealed Bid/Tender is opened. If written confirmation is not received within two days after scheduled time for opening, no consideration will be given to telegraphic modification.

1.8 IRREGULAR BID/TENDERS

A. Bid/Tenders are considered irregular and may be rejected for following reasons unless otherwise provided by law:

1. If form furnished is not used or is altered.
2. If there are unauthorized additions, conditional bids, or irregularities of any kind which may tend to make Bid/Tender incomplete, indefinite, or ambiguous as to its meaning.
3. If bidder adds any provisions reserving right to accept or reject any award, or to enter into Contract pursuant to an award.
4. If unit or lump sum prices contained in bid schedule are obviously unbalanced either in excess of, or below, reasonable cost analysis values.
5. If bidder fails to insert alternate and unit prices for every item requested.
6. If bidder fails to complete Bid/Tender in any other particulars where information is requested so Bid/Tender cannot be properly evaluated.

B. Owner reserves right to reject any or all Bid/Tenders and to waive irregularities or informalities as may be deemed in Owner’s interest.

1.9 QUALIFICATION OF BIDDER

A. The Owner may make such investigations as deems necessary to determine the ability of each 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.

B. 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 Contract and to complete the work contemplated therein.

C. The Owner will require the bidder to whom a Contract may be awarded to submit any of the following information before the award of the Contract:

1. A breakdown of the bid (Schedule of Values) submitted including a listing of the subcontractors’ names for each trade proposed to be used for this project. ***Note: The Owner and Architect reserve***

the right to reject any sub-contractor whom the Owner or Architect has experienced poor performance on past projects. Additionally, only Owner/Architect approved sub-contractors will be permitted to perform work on the project. Sub-contractors will not be permitted to sub-contract work without pre approval of the Owner and Architect.

2. Such additional information as will satisfy the Owner that the Bidder is adequately prepared to fulfill the Contract.

D. The Owner reserves the right to interview the two (2) lowest Bidders prior to award of the contract. Bidder will be requested to bring to the interview the project manager and project superintendent that will be assigned the project along with resumes for each of these individuals. This will be a question and answer format.

1.10 INTERPRETATIONS

A. If Bidder for proposed work is in doubt as to true meaning of any part of Contract Documents, submit written request for interpretation. Bidder submitting request is responsible for its prompt and actual delivery. Interpretations will not be made orally.

B. Submit written request for interpretation to ATTN: Mr. Gregory N. Mason, A.I.A., CHMP, INC., 5198 Territorial Road, Grand Blanc, MI 48439. All interpretations or supplemental instructions will be in form of written addenda mailed prior to date fixed for opening of bids. Copy of such addendum will be mailed to each individual or entity issued Contract Documents. Failure to receive such addendum does not relieve bidder from any obligation under his bid as submitted. All addenda are part of the Contract Documents. The final day for issuing questions prior to the bid due date is Thursday, April 27, 2017 at 5:00 p.m. No questions will be accepted after this time.

C. Bidder desiring approval of material or equipment not specified must comply with Section 00440.

1.11 METHOD OF AWARD

A. If lowest base bid submitted by qualified bidder does not exceed amount of funds available to finance Contract, Contract may be awarded on base bid.

B. If base bid exceeds such amount, Owner may reject all bids or choose to enter negotiations with the lowest qualified bidder.

C. Owner may award Contract on base bid plus any or all alternates if amount is within available funds.

D. Any other provision of the Contract Documents notwithstanding, notice of acceptance of a Bid/Tender and execution of the Contract by the Owner are each conditioned as to their effectiveness upon the bidder to whom notice of acceptance has been given executing the Contract, delivering properly executed performance and payment bonds to the Owner, and doing both of these within 15 days of the notice to acceptance having been given. Immediately after these conditions are satisfied, the Contract automatically becomes awarded.

1.12 EXAMINATION OF SITE

A. Before submitting a proposal, each Bidder shall inspect the site of the proposed work to arrive at a clear understanding of the conditions under which the work is to be done. He well be held to have compared the premises with the drawings and specifications, and to have satisfied himself as to all conditions affecting the execution of the work.

B. No allowance or extra compensation concerning any matter or thing about which the Bidder might have fully informed himself will be allowed.

1.13 PRE-BID CONFERENCE

A. A **mandatory** pre-bid conference will be held on Tuesday, April 18, 2017, at 10:00 a.m., EDT at Clyde Township, 3350 Vincent Road, North Street, MI 48049, for review of the documents and response to questions which may arise. All Bidders are required to attend and sub-contractors are encouraged to attend. Immediately following this meeting will be a "meet the local sub-contractor meeting" allowing the bidders to gather information on local sub-contractors and material suppliers in order to meet the Owner's goal of maximizing local participation.

1.14 LOCAL PARTICIPATION

A. It is the collective desire of Clyde Township to support local participation of local contractors and material suppliers on this project. As a result, local participation (St. Clair County, sub-Contractors, and material suppliers) will be highly considered in the award of this project. All bidders will be required to submit a plan identifying local participation along with their bid tender. This plan shall list the name, address, and trade of each local sub-Contractor or material supplier schedule to participate on this project. Refer to the Appendix of this project manual for a list of local sub-contractors and material suppliers.

1.15 BASE BID, ALTERNATES AND UNIT PRICES

A. General: Bid must include base bid, all alternates and all unit prices. In the event alternate does not affect Bidder's work, enter "No Change". Absence of any entry will be assumed to indicate zero price and time change.

1.16 SECURITY FOR FAITHFUL PERFORMANCE

A. Successful bidder will be required to furnish performance, labor and material payment bonds in the amount of 100% of the Contract sum.

B. Surety on such bonds shall be a duly authorized company satisfactory to the Owner.

END OF SECTION 002113

DOCUMENT 003100 - BID/TENDER FORM

FOR: Clyde Township Municipal Center
Site & Building Improvements
3350 Vincent Road
North Street, Michigan 48049

DATE: _____

NAME OF BIDDER: _____

ADDRESS _____

TELEPHONE: ( ) _____

TO: Clyde Township (hereinafter called "Owner")

Gentlemen:

The Bidder, in compliance with your invitation for bids for work on Clyde Township Municipal Center, Site & Building Improvements (CHMP Project No. 16000800) having examined the Contract Documents prepared by CHMP, Inc., dated Issue for Bidding, April 11, 2017, respectively, and other related documents and being familiar with site of proposed work, and with all conditions surrounding construction of proposed project including availability of materials and labor, hereby propose to furnish all labor, materials, tools, equipment, machinery, equipment rental, transportation, superintendence, perform all work, provide all services, and to construct all work in accordance with Contract Documents, within time set forth herein, at prices stated below. These prices are to cover all expenses incurred in performing work required under Contract Documents, of which this Bid/Tender is a part.

Successful bidder agrees to provide performance and payment bonds written by surety acceptable to Owner. Made in favor of Owner as oblige.

BASE BID – CLYDE TOWNSHIP MUNICIPAL CENTER – SITE & BUILDING IMPROVEMENTS:
Bidder agrees to perform all work as described in the Contract Documents, for Lump Sum of

_____

_____ ($ _____).

Bidder, if awarded a Contract, hereby agrees to commence and complete work under this contract in compliance with the project schedule provided within Section 011113 - "Summary of Work". Bidder also acknowledges that non-compliance with the project schedule is subject to liquidated damages.

ALTERNATES:

The following Alternates shall be expressed in words and figures as an ADDITION or DEDUCTION to Base Bid as indicated. Refer to Section 012300.

Alternate No. 1, South Parking Improvements: ADD the sum of _____

_____ ($ _____)

UNIT PRICES:

If the following items of work are added or deducted from quantities required by the construction documents, unit prices will apply as stated. (Refer to section 012200 for detailed definitions of unit prices).

(Show amounts in both words and figures. In case of discrepancy, amount shown in words will govern)

		ADD	DEDUCT
Price No. 1:	Hidden Rock and Concrete Excavation and Removal	$ _____ /C.Y.	$ _____ /C.Y.
Price No. 2:	Engineered Fill, C.I.P.	$ _____ /C.Y.	$ _____ /C.Y.
Price No. 3:	Contaminated Earth Excavation and Removal (Class II Landfill)	$ _____ /C.Y.	$ _____ /C.Y
Price No. 4:	Unsuitable Soil Excavation and Removal	$ _____ /C.Y.	$ _____ /C.Y.
Price No. 5:	Erosion Control, Silt Fence	$ _____ /L.F.	$ _____ /L.F.
Price No. 6:	Parking Blocks, Recycled Plastic	$ _____ /Each.	$ _____ /Each
Price No. 7:	HMA, 3C	$ _____ /Ton	$ _____ /Ton
Price No. 8:	HMA, 13A	$ _____ /Ton	$ _____ /Ton

FEES FOR CHANGE IN WORK

The undersigned agrees that if awarded the contract for this work, it will, upon request by the Owner, perform additional work or omit specified work, or cause same to be performed or omitted by subcontractors, for the following percentage fees which have been computed in accordance with the requirements of Section 01:

	Additions	Omissions
Work By Contractor's Own Forces	_____ %	_____ %
Work By Subcontractor's Forces	_____ %	_____ %

It is agreed that in this context a subcontractor shall be as specified in Article 5 of the General Conditions.

PROPOSED SUBSTITUTIONS

The undersigned submits for consideration by the Owner and/or the Architect-Engineer the Proposed Substitutions as listed hereinafter, each item being offered as a substitute for the referenced specified item which was used in compiling the Lump Sum Price of this Proposal and each price having been computed in accordance with the requirements of Section 012500.

Proposal Item	Proposed Substitution	Add	Deduct
1.		$	$
2.		$	$

3. _____ _____ $_____ $_____

The bidder agrees that the Owner may accept or reject any or all of the above Proposed Substitutions, and that the work applicable to any items which are accepted will be performed in accordance with the requirements of the drawings and specifications.

Bidder understands that the Owner reserves right to reject any or all Bid/Tenders and to waive any informalities or irregularities herein.

Upon notice of acceptance of this Bid/Tender, bidder will execute Contract Agreement and deliver properly executed Performance and Payment Bonds to Owner within 15 days.

Bidder acknowledges receipt of following addenda:

_____

_____

_____

If awarded a contract, bidder's surety will be (name of Surety Company).

_____

_____

CERTIFICATION OF SITE VISIT

The undersigned hereby affirms that is has complied with the requirements for visiting the site as detailed in the Instructions To Bidders.

ADDRESS, LEGAL STATUS, AND SIGNATURE OF BIDDER

The undersigned does hereby designate the address, given below, as the legal address to which all notices, directions, or other communications may be served or mailed.

P.O. Box (if applicable) _____

Street _____

City _____ State _____ Zip Code _

The undersigned does hereby declare that it has the legal status checked below.

_____ Individual

_____ Co-Partnership

_____ Corporation Incorporated under the laws and State of _____

The names and address of all persons indicated as partners in this Bid Proposal are as follows:

NAME ADDRESS

_____ _____

_____ _____

_____ _____

This Bid Proposal is submitted in the name of:

_____
(Name of Contractor)

By _____

Title _____

Signed and sealed this _____ Day of _____, 20 ____ .

INSTRUCTIONS: Submit two (2) copies to Owner and retain one (1) copy.

SECTION 004400 - SUBSTITUTIONS PRIOR TO AWARD OF CONTRACT

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all work and services for furnishing, submitting, processing and handling of requests for substitutions prior to award of contract. Any substitution must be in accord with provisions of Contract Documents.
2. Completely coordinate with work of other trades.
3. See appropriate sections for specific items.
4. See General Conditions for additional information.

B. Address for submission:

1. ATTN: Mr. Gregory N. Mason, A.I.A.
CHMP, INC.
5198 Territorial Road
Grand Blanc, MI 48439

1.2 PRODUCT SELECTION - GENERAL

A. Base all bids on materials, equipment and procedures specified.

B. Certain types of equipment and kinds of materials are described in specifications by means of trade names, catalog numbers or manufacturer's names. This is not intended to exclude from consideration other items which may be capable of accomplishing purpose indicated.

C. Other types of equipment and kinds of material may be acceptable to Owner and Architect.

1. Clyde Township is open to substitutions that will include cost effective energy efficiencies. Please submit initial and future cost savings calculations along with required material documentation.

D. Listing of a manufacturer implies acceptance of them only as supplier of a specified product.

E. Equipment and materials, if not specifically indicated must be approved in writing by Architect ad be agreed upon by Owner's Representative/Construction Manager prior to letting of Contract.

F. Architect reserves right to require substitutions to comply color and pattern-wise with base specified items.

G. No substitutions will be permitted between Bid/Tender opening and execution of the Contract.

H. No substitution permitted after letting of Contract, except as indicated in Section 012500.

I. Conditional bids and voluntary alternates will not be considered.

1.3 REQUEST FOR SUBSTITUTIONS

A. Only written requests with complete submittal data will be considered.

B. Sub requests in electronic format.

C. Requests must be received by CHMP, INC. At least five (5) days prior to date fixed for opening of Bid/Tenders.

D. In making request for substitutions, or in using an approved substitute item, Bidder represents:

1. He has investigated proposed product of method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function.
2. He will provide same guarantee for substitute item as for product or method specified.
3. He will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
4. He waives all claims for additional costs or time related to substitution which subsequently become apparent.
5. Acknowledge acceptance of these provisions in request.

E. Substitutions presented/submitted on the Bid/Tender Form which have not been pre-approved by the Architect/Engineer will be considered only if the substitution benefits the Owner.

F. Acceptable substitutions will be authorized by a Change Order.

G. All proposed substitutions shall be subject to evaluation by the Construction Manager/Architect/Engineer as to compliance with the Contract Document requirements. The Construction Manager/Architect/ Engineer's decision shall be final.

H. The burden of proof of equality shall rest entirely with the Contractor. All substitutions proposed shall be accompanied by complete manufacturer's product data, specifications, and other pertinent information. Cost data shall reflect all modifications required to adjacent construction to accommodate the proposed substitution. Submit complete details of such modifications for Construction Manager/Architect/ Engineer's approval.

1.4 SUBSTITUTION SUBMITTAL DATA

A. Complete data substantiating compliance of proposed substitution with Contract Documents.

B. For products:

1. Products identification, including manufacturer's name.
2. Manufacturer literature, marked to indicate specific model, type, size, and options to be considered:

a. Product description.
b. Performance and test data.
c. Reference standards.
d. Difference in power demand, air quantities, etc.
e. Dimensional differences from specified unit.

3. Full size samples if requested. Architect reserves right to impound sample until physical units are installed on project for comparison purposes. Requester pay all costs of furnishing and return of samples. Architect is not responsible for loss of, or damage to, samples.

4. Name and address of similar projects and name of Owner's representative we can contact, to discuss products, installation, and field performance data.

C. For construction methods:

1. Detail description of proposed method.
2. Illustrate on drawings.

D. Itemized comparison of proposed substitute to specified item.

E. Data relating to changes in construction schedule.

F. Relation to separate contracts.

G. Cost of proposed substitution in comparison with product or method specified.

1.5 REJECTION OF SUBSTITUTIONS

A. Substitutions will not be considered if:

1. They are not submitted in accord with this section.
2. Acceptance will require substantial revision of Contract Documents, or building spaces.
3. Request for substitution does not indicate specific item for which request is submitted. Acceptance of manufacturer only will not be made.

END OF SECTION 004400

SECTION 005100 - AGREEMENT (A.I.A. A101-2007)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Use the following American Institute of Architects document: A101-2007 Standard Form of Agreement Between Owner and Contractor - Stipulated Sum, is hereby made a requirement of the Contract Documents.

END OF SECTION 005100

AIA® Document A101™ – 2007

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than ( ) days from the date of commencement, or as follows:

(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

§ 4.3 Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit ($0.00)

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of percent (%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of percent (%);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and

(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:

(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

%

§ 8.3 The Owner's representative:

(Name, address and other information)

§ 8.4 The Contractor's representative:

(Name, address and other information)

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Date	Pages

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents

unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.

(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond	Limit of liability or bond amount ($0.00)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	CONTRACTOR *(Signature)*
(Printed name and title)	*(Printed name and title)*

SECTION 006100 - PERFORMANCE BOND AND PAYMENT BOND

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a specific Performance Bond in the amount of 100% of the accepted bid amount as required by 1956 PA 32 as amended 1963 PA 213, being MCL 129.201, for public work in the State of Michigan.

1. The Performance Bond shall contain no statute of limitations.
2. The Performance Bond shall contain a clause that if the Contractor performs as agreed in the Contract, the bond is void, otherwise it remains in full force and effect.

B. Provide a Payment Bond in the amount of 100% of the accepted bid amount in compliance with Michigan Statute 1963 PA 213.

1. Bond shall state on its face, that it is in compliance with the Michigan Statute 1963 PA 213.

1.2 SUBMITTALS

A. Properly executed Performance and Payment Bond, prior to award of Contract and within 10 days of notice acceptance of Bid/Tender.

END OF SECTION 006100

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount:
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)
Amount:

Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or BROKER:

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

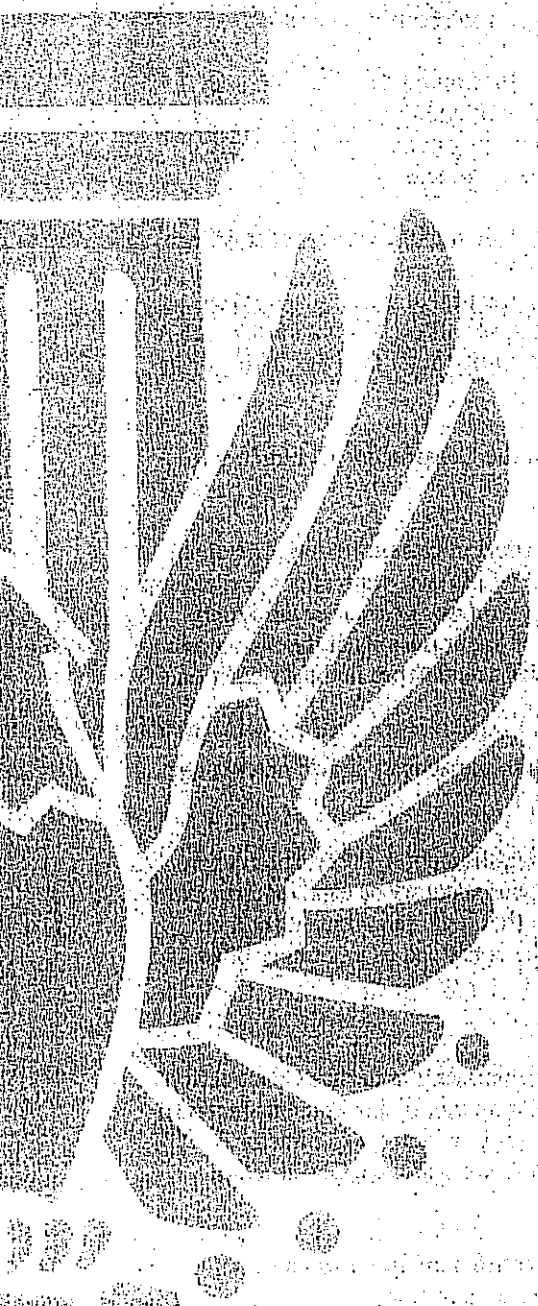
§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:



(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL	SURETY
Company: *(Corporate Seal)*	Company: *(Corporate Seal)*
Signature:	Signature:
Name and Title:	Name and Title:
Address	Address

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.
Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.
AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

CONSTRUCTION CONTRACT
Date:
Amount:
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)
Amount:

Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or BROKER:

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

.1 the name of the Claimant;

.2 the name of the person for whom the labor was done, or materials or equipment furnished;

.3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;

.4 a brief description of the labor, materials or equipment furnished;

.5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

.6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;

.7 the total amount of previous payments received by the Claimant; and

.8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

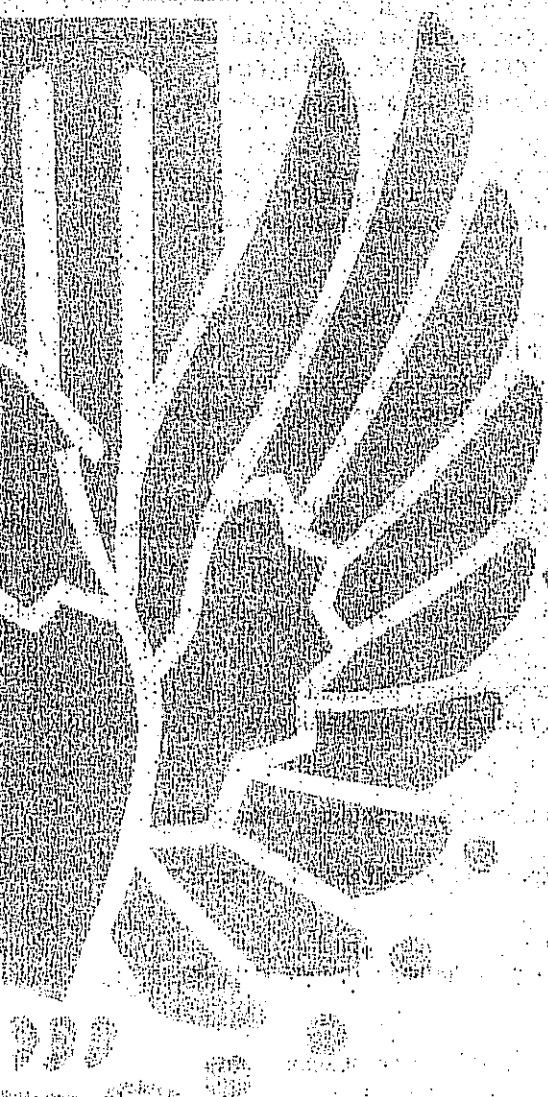
§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:



(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL	SURETY
Company: *(Corporate Seal)*	Company: *(Corporate Seal)*
Signature:	Signature:
Name and Title:	Name and Title:
Address	Address

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

SECTION 007100 - GENERAL CONDITIONS OF THE CONTRACT (A.I.A. A201-2007)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Use of the following American Institute of Architects document: A201-2007 General Conditions of the Contract for Construction is hereby made a requirement of the Contract Documents.

B. See Sections 008000 for modifications.

END OF SECTION 007100

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

THE OWNER:
(Name and address)

THE ARCHITECT:
(Name and address)

TABLE OF ARTICLES

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INDEX
(Numbers and Topics in Bold are Section Headings)

Init.
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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct,

but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design 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 the Architect. The Owner and the Architect shall be entitled

to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce

other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate For Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the

Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner, separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum; and

.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be

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furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a separate contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

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§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, 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 for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents; or

.3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and

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

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance, or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

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

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

.4 Claims for damages insured by usual personal injury liability coverage;

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

.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations; and

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's

risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker.

Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

Init.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

SECTION 008000 - SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 SUPPLEMENTS

A. Following supplements modify, change, delete from or add to General Conditions of the Contract for Construction, AIA document A201, 2007 Edition. Where any article of General Conditions is modified, or any paragraph, subparagraph or clause thereof is modified or deleted, unaltered provisions of that article, paragraph, subparagraph or clause remain in effect.

PART 2 - AMENDMENTS

2.1 ARTICLE 1 - GENERAL PROVISIONS

A. Add to subparagraph 1.1.3:

1. All Contractors and subcontractors are responsible for compliance with all applicable sections and articles which pertain to their aspect of the Work, and for cleaning up as provided in subparagraph 3.15.1 and Section 017100.

B. Add new clauses:

1. 1.2.1.1 In case of disagreement between drawings and specifications, or within either document itself, better quality or greater quantity of work will be basis of contract.
2. 1.2.2.1 Contractor is solely responsible for coordination of bidding and scope of Work of subcontractors. Except as specifically provided in Subparagraphs 4.2.11 and 4.2.12, the Architect will not act as arbiter as to which trade or subcontractor is to furnish and install various items indicated or required to perform construction.

2.2 ARTICLE 2 - OWNER

A. 2.1.2 Owner as referred to in these documents is: Clyde Township.

B. Add to subparagraph 2.2.3:

1. Information will be furnished only to extent it is readily available to Owner.

C. Add new clause:

1. 2.2.5.1 Architect will provide Contractor with revisions to drawings, and specifications as may be required to show any authorized changes. Each Prime Contractor shall maintain, on work site, one complete set of Contract Documents to include all drawings, specifications, addenda, approved change orders and modifications during entire period of construction.

D. Add new subparagraphs:

1. 2.4.1 Owner may declare Contract in default for any one or more of the following reasons:

a. Failure to complete the Work within Contract period or any extension thereof.
b. Failure or refusal to comply with order of Architect within reasonable time.

c. Failure or refusal to remove rejected materials.
d. Failure or refusal to perform anew any defective or unacceptable work.
e. Bankruptcy or insolvency, or making of an assignment for benefit of creditors.
f. Failure to provide qualified superintendent, competent workmen or subcontractors to carry on the Work in an acceptable manner.
g. Failure to prosecute the Work according to agreed schedule of completion.
h. Default by the Contractor in the performance of any provisions of the Contract Documents.

E. Add new subparagraph 2.4.2:

1. 2.4.2 Neither Owner nor his officers, agents, or employees are in any way liable or accountable to Contractor or his surety for method by which completion of said work, or any portion thereof, is accomplished or for price paid therefore. Contractor is responsible for all costs of completing the Work including costs in excess of original Contract Price. Contractor will be paid the amount saved if costs of completion is less than the original Contract Price. Owner does not forfeit right to recover damages from Contractor or surety for failure to complete Contract by taking over the Work or by declaring Contract in default. Maintenance of the Work remain Contractor's responsibility until the Completion Date.

2.3 ARTICLE 3 - CONTRACTOR

A. Add new subparagraphs:

1. 3.2.2.1 By entering into an Agreement with Owner, Contractor acknowledges that he has : examined all documents pertaining to the Work, examined character of site and any existing structures, and has satisfied himself as to nature of the Work, and all other matters, which can in any way affect the Work.
2. Subparagraph 3.3.2 after word "Subcontractors" add: "or Sub-subcontractors".
3. 3.3.4 The Owner shall employ a Licensed Surveyor to located and stake out the Work and establish necessary reference and bench marks. Each Contractor, working from established bench marks and reference points, shall lay out and correctly establish all lines, levels, grades and locations of all parts of his own work and be responsible for their accuracy and proper correlation with work of other Contractors and established data.
4. 3.3.5 Acceptance of materials by or on behalf of the Owner does not bar future rejection if subsequently found to be defective or inferior in quality or uniformity to material specified, or are not as represented.

B. Add the following Subparagraph 3.6.1:

1. The Contract Price includes (i) all taxes and other items required to be withheld from Contractor's employees and any Subcontractors of Contractor, (ii) all sales taxes imposed or levied in connection with all materials, supplies and equipment supplied by Contractor in the performance of the Work, (iii) all value added, use, consumer and similar taxes, and (iv) fees and taxes for the issuance of all licenses and building permits for the performance of the Work (all of which are called the "taxes"). All of the taxes shall be paid by Contractor directly to the applicable taxing authority, and Contractor shall be solely responsible for payment of the same. Owner shall have the right to require, as a condition to the making of any payment, satisfactory evidence of payment of all the taxes by Contractor. Owner shall have the right to inspect all materials and supply invoices and the books and records of Contractor shall be available for inspection by Owner to verify such costs, and the payment of all the taxes. Prior to the final payment, Contractor shall itemize on a sworn statement the cost of all materials, supplies and equipment utilized in the performance of the Work.

C. Add new subparagraphs:

1. 3.10.4 Construction schedule: See Section 011000 and 013200.

2. 3.10.5 Progress reports: See Section 013200.
3. 3.11.2 Project record documents: See Section 017839.
4. 3.12.11 Submit Shop Drawings, Product Data, Samples and Project Data in accord with Section 013400 and Subparagraphs 3.11 and 3.12.
5. 3.12.12 Operating and maintenance data: See Section 017823.
6. 3.13.2 Confine all operations to areas indicated on drawings or authorized in writing by Owner.
7. 3.15.3 Cleaning up: See Section 017100 and Subparagraph 3.15.

D. Replace Section 3.18 - Indemnification with the following:
"To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with paragraph 11.3, the Contractor shall indemnify, and hold harmless, the Owner, Architect, Architect's consultants, agents and employees of any of them from and against claims, damages, penalties, losses and expenses, including but not limited to attorneys' fees arising out of or resulting from performance of the Work or entry onto the Property**,** provided that such claim, damages, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts them may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligations shall not be construed to negate, abridge or reduce other rights or obligations or indemnity which would otherwise exist as to a party or person described in the Paragraph 3.18."

2.4 ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

A. Add to subparagraph 4.2.1:

1. The Owner reserves the right to maintain representatives, in addition to the Architect's representatives, for the purpose of examining and testing materials, and for the inspection of the general character, methods, and progress of the work.

2.5 ARTICLE 5 - SUBCONTRACTORS

A. Add new subparagraphs:

1. 5.1.3 Architect will not deal directly with any subcontractor, sub-subcontractor or materials supplier. Contact will be made only through Contractor. Requests for information or clarification must be routed through Contractor.
2. 5.3.2 Contractor is fully responsible for acts and omissions of his subcontractors, and persons either directly or indirectly employed by them, or under their control, as he is for his own employees.
3. 5.3.3 Nothing in Contract Documents creates any contractual relationship between any subcontractor and Owner or Architect.

B. Amend subparagraph 5.2.1:

1. Add to the end of subparagraph 5.2.1 the following: "After initial approval of the Contractor's sub-contractor list per the submitted schedule of values, the Contractor shall not be permitted to change or add any sub-contractors without the Owner's and Architect's written approval nor shall any approved sub-contractor be permitted to sub-contract the work without written approval of the Owner and Architect.

2.6 ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

A. No Change.

1. Delete all references to Waiver of Subrogation.

2.7 ARTICLE 7 - CHANGES IN THE WORK

A. No Change.

2.8 ARTICLE 8 - TIME

A. Add new clause:

1. 8.1.2.1 Do not start work or store materials or equipment on site until Written notice to proceed is issued, or upon execution of Contract. Commence work within 10 calendar days of written notice to proceed or execution of Contract, whichever is earlier.

B. Add new clause:

1. 8.3.1.1 Owner may waive above requirements and grant extensions of time for any reason.

2.9 ARTICLE 9 - PAYMENTS AND COMPLETION

A. Add new subparagraph:

1. Refer to Standard Form of Agreement Between Owner and Contractor Article 5.1.3 for provisions covering payment procedures.
2. Delete the last two sentences of article 9.10.2.

B. Amend subparagraph 9.10.4:

1. Add to the end of article 9.10.4.1 the following: “and 3rd party claims”.

2.10 ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

A. Add to subparagraph 10.2.2:

1. Give notice in writing at least 48 hours before breaking ground, to all persons, Public Utility Companies, Owners of property having structures or improvements in proximity to site of the Work, Superintendents, inspectors, or those otherwise in charge of property, streets, water pipes, gas pipes, sewer pipes, telephone cables, electric cables, railroads or otherwise, who may be affected by Contractor’s operation, in order that they may remove any obstruction for which they are responsible and have representative on site to see that their property is properly protected. Such notice does not relieve Contractor of responsibility for any damages, claims, and defense of all actions against Owner and Architect resulting from performance of such work in connection with or arising out of Contract.

B. Add to subparagraph 10.2.4:

1. 10.2.4 When wrecking, excavation work or other similar potentially dangerous work is necessary, exercise utmost care so as not to endanger life or property. Contractor is fully responsible for any and all damages, claims and for defense of all actions against Owner and Architect resulting from

prosecution of such work.

C. Add new subparagraphs:

1. 10.2.8 Duty of Architect to conduct construction review of Contractor's performance does not include review of adequacy of Contractor's safety measures in, on, or near construction site.
2. 10.2.9 Maintain utilities or other service, indicating to be abandoned, in service until new facilities are provided, tested and ready for use.
3. 10.2.10 Return all improvements on or about site and adjacent property which are not shown to be altered, remove or otherwise changed to conditions which existed prior to starting work.

4. Add new paragraphs and subparagraphs:

a. 10.5 Water Precautions

1) 10.5.1 Keep all parts of site, including excavations, free from all accumulation of water, no matter what source or cause.
2) 10.5.2 Dispose of water in such manner as will not endanger public health or cause damage or expense to property. Comply with requirements of any public agencies having jurisdiction. If sewers and streets are allowed to be used for drainage or disposal of water during construction, maintain and leave these satisfactorily clean upon completion of work.

b. 10.6 Protection of Glass

1) 10.6.1 Replace all damaged or broken glass during and upon completion of project.

c. 10.7 Signs

1) 10.7.1 Do not erect signs, billboards, or advertisements on or about premises, except as required by Contract.
2) 10.7.2 Furnish and maintain all necessary signs required for prosecution of Work and as required by law.

6. All references within articles 10.3.2 and 10.3.3 regarding hazardous materials "rendered harmless" shall mean being in compliance with laws and standards of governing authorities having jurisdiction over each particular hazardous material encountered."

2.11 ARTICLE 11 - INSURANCE AND BONDS

A. Add new paragraph:

1. 11.6 Insurance: See Section 008100.

2.12 ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

A. Add to subparagraph 12.2.2.1:

1. 12.2.2.1 Contractor hereby agrees to keep all work constructed under Contract in good repair for minimum period of one year, unless longer period is specified in Contract Documents, from date of Substantial Completion of the Work. No provision of Contract Documents which limits maintenance period to less than one year from date of acceptance of the Work by Owner is valid. Upon written notice by registered or certified mail from Owner or Owner's representative to Contractor of any defect, functional or structural deterioration of the Work or improvement or any serious departure from standards of original construction described in Contract Documents, it must

be remedied by Contractor. Make sure remedy without further cost to Owner, including in part, all damages, caused by such defect, deficiency, deterioration or departure, and by its repair, replacement or correction.

2. 12.2.2.2 For purpose of establishing beginning of one-year period, date of Substantial Completion occurs when Certificate of Substantial Completion has been issued for Project. In case of Owner use and occupancy of portion of Work prior to completion of Project, one year period for said portion of work commences upon date of Owner occupancy. Completion of future portions of Project does not affect one year period for Work performed during this portion.
3. 12.2.2.3 This provision applies whether or not bond is required, as personal obligation by Contractor. If Contractor does not proceed to remedy such defects, deficiencies, deteriorations or departures called to his attention in notice, within ten consecutive calendar days after mailing of notice, Owner may cause repairs to be made as Owner deems best. Entire cost thereof will be paid by Contractor.
4. 12.2.2.4 Obligations of Contractor as herein provided are in addition to and not in limitation of any obligations imposed upon him by special warranties required by Contract Documents or otherwise prescribed by law.
5. 12.2.2.5 Owner will give prompt notice to Contractor by registered or certified letter mailed to Contractor's last known address and sending copy of such notice to surety. Such notice is mutually agreed to be sufficient and adequate.
6. 12.2.2.6 Such additional specific warranties on various subdivisions of the Work, as are required, shall be furnished by various subcontractors under each respective subdivision of the Work. However, responsibility for furnishing such specific warranties rests with Contractor.

B. Add following subparagraph:

1. 12.2.6 Cost of minor repairs to newly finished interior surfaces of building (not covered by Property Insurance), will not be borne by Owner. If Owner must make repairs, cost will be deducted from Contract Sum.

2.13 ARTICLE 13 - MISCELLANEOUS PROVISIONS

A. Add subparagraph 13.8.1: CONTRACTOR'S IDENTIFICATION

1. 13.8.1 Upon execution of this Agreement, Contractor will furnish Owner with its (a) federal employer's identification number or social security number, (b) state unemployment compensation number, (c) state builder's license (d) all required state construction safety regulations, and (e) certificates of insurance as required by this Agreement.

B. Paragraph 13.7 - COMMENCEMENT OF STATUTORY LIMITATION PERIOD

1. Replace subparagraph 13.7.1 in its entirety with the following: "Causes of action between the parties to this Agreement shall be subject to applicable statutes of limitations under Michigan Law".

2.14 ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

A. Subparagraph 14.1.1

1. Add at the end:

a. Provided, however, that the Contractor shall not have the right to terminate the Contract under this paragraph 14.1.1 if, prior to expiration of the last referenced seven day notice period, the amount the non-payment of which was the basis for stopping the Work under paragraph 9.7 shall have been paid.

B. Subparagraph 14.2.1

1. Add at the end:

a. The previous provisions of the Paragraph 14.2.1 notwithstanding, the Owner's right of termination shall be limited to any extent required by the Federal Bankruptcy Act or any other applicable law, regulation or court order.

2. Revise article 14.1.3 to indicate that the Contractor's profit shall be limited to a percentage of overall profit equal to the percentage of construction completed at time of termination.

C. Add new subparagraphs:

1. 14.2.5 In all cases of termination or Contractor default, Architect will bill Owner for cost of additional services required in connection with reissuing documents or completing the Work. Owner will deduct this sum from money due Contractor and pay it to the Architect.
2. 14.2.6 In case of delays in completion of the Work due to actions or inactions of Contractor or his subcontractors, which extend completion time for Contract, Architect will bill Owner for cost of additional services required due to this delay. Owner will deduct this sum from money due Contractor and pay it to Architect.

2.15 ARTICLE 15.4 - ARBITRATIONS

A. Amend subparagraph 15.4.1:

1. Add to the end of subparagraph 4.6.2, the following: "The parties shall be granted ninety (90) days to conduct discovery, which discovery will be guided by the Michigan Court Rules. The results of that discovery may be utilized in the arbitration proceedings for all purposes that would be permitted in the courts under the Michigan Court Rules. Issues of dispute involving discovery will be resolved by the Arbitrator(s) who will have the final and binding authority to resolve such disputes. A hearing date will be scheduled before the Arbitrator(s) in Genesee County, Michigan, as soon as possible following the selection of the Arbitrator(s) and a hearing will commence following the ninety (90) day discovery period. Each party shall select an arbitrator as expeditiously as possible and the parties' selected arbitrators shall select a third arbitrator who shall be the chairperson of the panel of arbitrators. The decision of two of the three arbitrators shall be binding of the parties."

END OF SECTION 008000

SECTION 008100 - INSURANCE

PART 1 - GENERAL

1.1 SUPPLEMENTS

A. The following supplements modify, change, delete from or add to General Conditions of the Contract for Construction, AIA document A101, 2007 Edition. Where any article of General Conditions is modified, or any paragraph, subparagraph, or clause thereof is modified or deleted, unaltered provisions of that article, paragraph, subparagraph, or clause remain in effect.

PART 2 - MODIFICATIONS

A. Add new subparagraphs:

1. 11.1.1.9 Liability Insurance shall name the Owner as an additional insured and shall include all major divisions of coverage and bond on a comprehensive basis, including:

a. Premises Operations (including X-C/U as applicable).
b. Independent Contractors'.
c. Products & Completed Operations.
d. Personal Injury Liability with Fellow Employee Exclusion deleted.
e. Contractual including specified provisions for Contractor's obligation under paragraph 3.18.
f. Owned, non-owned and hired motor vehicles.
g. Broad Form Property Damaged including Completed Operations.
h. Umbrella Excess Liability.

2. 11.1.2.1 The insurance required by subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law:

a. Worker's Compensation

1) State: Statutory
2) Applicable Federal (e.g., Longshoremen, harbor work, Work at or outside U.S. Boundaries): Statutory
3) Benefits required by Union labor contracts:
4) Employer's Liability:
$2,000,000.00 Each Occurrence

b. Comprehensive General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

1) Bodily Injury:
$2,000,000.00 Each Occurrence
$2,000,000.00 Aggregate, Products and Completed Operations

2) Property Damage:
$2,000,000.00 Each Occurrence
$2,000,000.00 Aggregate

3) Products and Completed Operations Insurance shall be maintained for a minimum period of six (6) months after final payment with evidence of such coverage to Owner.

4) Property Damage Liability Insurance shall include coverage for the following hazards:
   a. X (Explosion)
   b. C (Collapse)
   c. U (Underground)
   $2,000,000.00 Each Occurrence
   $2,000,000.00 Annual Aggregate

5) Contractual Liability:
   a. Bodily Injury:
   $2,000,000.00 Each Occurrence
   $2,000,000.00 Annual Aggregate

6) Personal Injury, with Employment Exclusion deleted:
   $2,000,000.00 Annual Aggregate

c. Comprehensive Automobile Liability:

1) Bodily Injury:
   $2,000,000.00 Each Person
   $2,000,000.00 Each Accident

2) Property Damage:
   $2,000,000.00 Each Occurrence

If the State has a no-fault automobile insurance requirement. Contractor shall be certain coverage is provided which conforms to any specific stipulation in law.

d. Aircraft Liability (owner and non-owner) when applicable, with limits proposed by Contractor for Owners approval.

e. Watercraft Liability (owned and non-owned) when applicable, with limits proposed by Contractor for Owners approval.

3. 11.1.4.1 Furnish Certificates of Insurance which specifically set forth evidence of all coverage required of the Contractor, on form AIA G705, attached. Furnish to the Owner copies of all endorsements that are subsequently issued amending coverage or limits.

4. 11.1.4.2 Owner and its officials and employees, and CHMP shall be included as additional insureds under all coverages (except workers' compensation, employer's liability and Professional Liability) required by this contract and such additional insured status shall be specifically identified on the certificate of insurance. All policies are required to be endorsed to indicate that policies provide primary coverage without right of contribution by any insurance carried or self-insured by Owner. All policies of insurance required to be carried by the Contractor shall be written by responsible insurance companies authorized to do business in the State of Michigan with a Best rating of at least A: VII. A copy of each paid-up policy evidencing such insurance or a certificate of the insurer, certifying that such policy has been issued, providing the coverage required hereby and containing provisions specified herein, shall be delivered to the Owner prior to Contractor commencing the work and, upon renewals, not less than thirty (30) days prior to the expiration of such coverage. The Owner may, at any time, and from time to time, inspect and/or

copy any and all insurance policies required to be procured by the Contractor hereunder. Each certificate of insurance or policy evidencing insurance required to be carried hereunder shall contain a provision that the insurer will not cancel, materially change or fail to renew the coverage provided by such policy without first giving Owner thirty (30) days prior written notice. All deductibles required by such insurance policies shall be the obligation of the Contractor. Compliance by the Contractor with the insurance requirements set forth herein shall not relieve the Contractor from liability for amounts in excess of the required limits on insurance.

END OF SECTION 008100

SECTION 011113 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. This project located at 3350 Vincent Road in North Street, Michigan shall be completed in 3 phases. Building and site improvements are as shown on the contract documents prepared by CHMP, INC. issued for bid, Tuesday April 11, 2017.

B. Requirements of the work are contained in the Contract Documents, and include cross-references to published information, which is not necessarily bound therewith.

C. Without force and effect on requirements of Contract Documents, a description of the work of the Contract can be summarized as follows:

1. Demolition:

a. Site Demolition work includes the removal of concrete pavement, landscaping, light poles, flagpole, and pulverization of existing asphalt pavement.

b. Selective Building Demolition work includes the removal of roofing systems; entrance porch construction, doors and windows, interior finishes (floor & ceilings); interior partitions, plumbing fixtures and piping; heating system and ductwork; electrical systems (power and lighting).

2. Site Work:

a. Site clearing including the removal of trees, brush and topsoil.

b. New site construction includes: bituminous paving, pavement markings, concrete paving, prefabricated wheel stops, underground utility services, modification of existing water services, site lighting, site signage, flagpoles, and landscaping, and all other items referenced in the Construction Plans.

3. Building Addition and Improvements

a. Construct a 3,021 s.f. building addition and remodel the existing 2,603 s.f. building.

b. The building addition will be constructed with brick veneer over building wrap over OSB sheathing over wood stud perimeter wall framing supporting overhead wood trusses with plywood sheathing. Finish roofing shall be architectural grades shingles over combination ice & water shield/synthetic underlayment. Foundations shall be concrete trench footings with steel reinforcing with one course of block above. Finishes shall consist of gypsum board over wood studs interior partitions, carpeting, resilient flooring, porcelain tile, and suspended acoustical tile ceilings. Insulation shall include perimeter rigid insulation, mold resistant cellulous insulation in perimeter stud cavities and attic. Architectural work shall include doors and hardware, millwork, prefinished glass and aluminum entrances, vinyl faced insulated wood windows, and toilet accessories. The mechanical work shall include all plumbing & piping systems including fixtures, Forced air heating/cooling system with pad mounted condensing units. Electrical systems shall include electrical power and distribution system and lighting systems.

1.2 DESIGNATION OF ASSOCIATIONS, INSTITUTIONS, SOCIETIES AND STANDARDS

A. Whenever these Specifications reference is made to Associations, Institutions, Societies, or Standards, they will be designated as follows:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufactures Association
ACI	American Concrete Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron & Steel Institute
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials and Code Administrators
BLS	Bureau of Labor Standards
CISPI	Cast Iron Soil Pipe Institute
FS	Federal Specifications
I=B=R	Institute of Boiler and Radiator Manufacturers
IEEE	Institute of Electrical and Electronic Engineers
MDOT	Michigan Department of Transportation
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
SSPC	Steel Structures Painting Council
UL	Underwriters Laboratories, Inc.

B. Wherever specific standard numbers are indicated, i.e., ASTM C-150, it shall be understood to mean the latest edition thereof.

1.3 WORK SCHEDULE

A. The anticipated project award date is May 23, 2017. The mandatory completion date for reaching substantial completion of the project is May 23, 2018. This project is subject to liquidated damages as indicated under Section 002113 – Instructions to Bidders. The General Contractor shall be responsible for completing the project on or before the mandatory completion date.

B. It is the collective intention of the Owner to have the proposed work completed in the most expeditious manner without unduly compromising the quality of the project. In order to achieve the goals stated above, the utmost cooperation of all trades involved with the work will be required.

1.4 ITEMS FURNISHED BY OTHERS

A. The General Contractor shall include all items and work shown or called for on the drawings and in the specifications, except those items and work marked specifically “N.I.C.” (Not In Contract), or listed as “F.B.O.” (Furnished by Others, but requiring installation and coordinated items of work by the Contractor). Owner-provided equipment will be received and installed by related contractor:

B. All items furnished and installed by others but requiring connection to the electrical or mechanical systems shall be hooked up or connected by the General Contractor.

C. The General Contractor shall cooperate in every respect with other Contractors performing work directly for the Owner to the extent and intent that a complete operable and fully equipped building is produced.

1.5 CONTRACTOR USE OF PREMISES

A. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

B. Keep driveways and entrances clear during business hours. Do not use these areas for construction parking or storage of materials. Schedule deliveries to minimize requirements for storage of materials on-site.

END OF SECTION 011113

SECTION 011413 - CONTRACTOR'S USE OF THE PREMISES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: This section applies to situations in which the Contractor or his representatives including, but not necessarily limited to, suppliers, subcontractors, employees, and field engineers, enter upon the Owner's property.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Promptly upon award of the Contract, notify all pertinent personnel regarding requirements of this Section.

B. Require that all personnel who will enter upon the Owner's property certify their awareness of familiarity with the requirements of this Section.

1.3 USE OF PREMISES

A. The Contractor shall confine his apparatus, storage of materials and operations of his workmen to limits as required by the Architect, and shall not unreasonably encumber the premises with his materials.

B. The Contractor shall maintain access to and egress from the project site in a safe manner, well marked and in locations as required by the local authorities having jurisdiction over this work. They shall be responsible for furnishing and maintaining in a safe condition all barricades, temporary enclosures, railings and lights and removal of same at completion of job.

C. At no time shall the structure be loaded beyond safe limits, and in no case shall any loads exceed the design limits.

D. All work shall be done during the regular work hours of the day. Contractor shall conform to Clyde Township's ordinances and regulations. All work carried on outside of regular working hours shall be done at the Contractor's expense, no extras will be allowed. The use of "overtime" shall be at the Contractor's option.

END OF SECTION 011413

SECTION 012113 - CASH ALLOWANCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The following cash allowances shall be included in the Base Bid and shall be disbursed only upon written authorization of the Architect. Any part of these allowances not so disbursed will be deducted from the Contract Sum.

B. The cash allowances do contain amounts for furnishing, sales taxes, and delivery to the job site.

C. The cash allowances, except as otherwise noted, **do not** contain amounts for installation costs of the above items when purchased, overhead, profit, fee, or other costs of the Contractor. The Contractor shall include in the Base Bid such amounts for said expenses and profit, if any on account of cash allowances as he deems proper.

D. Description of allowances:

1. Permits & Fees:

a. All required permit fees shall be obtained and paid by the General Contractor.

2. Exterior Building Signage Allowance

a.	Pedestal Mounted Electronic Sign	$ 7,500.00
b.	Building Mounted Sign	$ 3,500.00

3. Interior Building Signage Allowance $ 3,500.00

END OF SECTION 012113

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

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

1. Division 1 Section 005100 “Agreement” for procedures for submitting and handling Change Orders.
2. Division 31 Section "Earth Moving" for procedures for measurement and payment for authorization for additional work.

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, profit, and applicable taxes.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

D. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE

A. Unit Price No. 1 - Rock and Concrete Excavation and Removal:

1. Description: Hidden rock and concrete excavation and removal according to Division 31 "Earthwork."
2. Unit of Measurement: Cubic yard of rock or concrete, excavated in place.

B. Unit Price No. 2 - Engineered Fill, compacted in place:

1. Description: MDOT Granular Material Class 2 (clean sand) compacted in place to 95% of modified proctor (ASTM D1557) value.
2. Unit of Measurement: Cubic yard of material, furnished and compacted in place.

C. Unit Price No. 3 - Contaminated Earth Excavation and Removal (Class II Landfill):

1. Description: Removal and legal disposal of contaminated soil.
2. Unit of Measurement: Cubic yard of material, excavated in place.

D. Unit Price No. 4 - Unsuitable Soil Excavation and Removal.

1. Description: Removal and disposal of unsuitable soils.
2. Unit of Measure: Cubic yard of material, excavated in place.

E. Unit Price No. 5 – Erosion Control, Silt Fence.

1. Description: Furnish, install and maintain Geotextile Fabric Silt Fence per plan detail, in accordance with Division 21 “Soil Erosion.”
2. Unit of Measure: Linear foot.

F. Unit Price No. 6 – Parking Blocks, Recyled Plastic

1. Description: Furnish and install recycled plastic parking blocks in accordance with manufacturer’s specifications.
2. Unit of Measure: Each.

G. Unit Price No. 7 – HMA, 3C

1. Description: Furnish and install Hot Mix Asphalt (HMA), MDOT mix design 3C, in accordance with specifications.
2. Unit of Measure: Ton.

H. Unit Price No. 8 – HMA, 13A

1. Description: Furnish and install Hot Mix Asphalt (HMA), MDOT mix design 13A, in accordance with specifications.
2. Unit of Measure: Ton.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

B. Notification: Immediately following the award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate whether alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other Work of this Contract.

D. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ADD Alternate No. 1: Cold milling and HMA resurfacing of the South parking lot.

1. Deduct Aggregate Base, 4 inch, HMA Millings, -200 Syd
2. Deduct Aggregate Base, 8 inch, MDOT 21A or 21AA Crushed Limestone, -265 Syd.
3. Deduct Seal Coat, Ex HMA Surface, -880 Syd
4. Add Aggregate Base, 4 inch, using MDOT Sand, Cl 2 Granular Material, 200 Syd.
5. Add Aggregate Base, 8 inch, using HMA Millings, 265 Syd.
6. Add Cold Milling HMA Surface, 1.5 inches, cold milling South parking lot, 880 Syd.
7. Add HMA, 13A, additional HMA pavement resurfacing of the South parking lot, 80 Ton.

Referenced drawings include: SP-1, DT-1.

END OF SECTION 012300

DOCUMENT 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all work and services for furnishing, submitting, processing and handling of requests for substitutions and data for product options after execution of Contract. Any substitution or product option must be in accord with provisions of Contract Documents.
2. Completely coordinate with work of other trades.
3. See appropriate sections for specific items.
4. See General Conditions for additional information.

B. Address for submission:

CHMP, INC.
5198 Territorial Road
Grand Blanc, Michigan 48439

1.2 PRODUCT SELECTION - GENERAL

A. All bids are based on materials, equipment and procedures specified.

B. Certain types of equipment and kinds of materials are described in specifications by means of trade names, catalog numbers and/or manufacturer's names.

C. Listing of a manufacturer implies acceptance of them only as supplier of a product option items to comply color and pattern-wise with base specified items.

D. Architect reserves right to require substitutions or product option items to comply color and pattern-wise with base specified items.

E. No substitution permitted between bid opening and execution of Contract.

F. No substitution permitted after execution of Contract, except by change order.

1.3 CONTRACTOR'S OPTIONS

A. For products specified only by reference standards, use any product meeting standards.

B. For products specified by naming several products or manufacturers, use any product or manufacturer named.

C. For products specified by naming one manufacturer and product and several optional manufacturers or products, select any named product and manufacturer which meets all specification criteria.

1. Contract Documents are based on use of specified manufacturer.
2. By using an optional manufacturer or product, Contractor represents that he will be responsible for all adjustments to fit product to the work and for providing all additional work, equipment, and services required by use of product, at no additional cost to the Owner.

1.4 SUBSTITUTION AFTER EXECUTION OF CONTRACT

A. No substitution will be considered after execution of Contract except for non-availability of specified item due to:

1. Strikes.
2. Lockouts.
3. Bankruptcy.
4. Discontinuance of production.
5. Proven shortage.
6. Similar occurrences.

B. Notify Architect, in writing, with substantiating data as soon as non-availability becomes apparent.

C. Notify in time to avoid delay in construction.

D. Forward submittal data as required for substitutions.

1.5 REQUESTS FOR SUBSTITUTION

A. Only written requests with complete submittal data will be considered.

B. Submit request in three copies.

C. In making request for substitutions, or in using an approved substitute item, Contractor represents:

1. He has investigated proposed product or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function.
2. He will provide same guarantee for substitute item as for product or method specified.
3. He will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
4. He waives all claims for additional costs or time related to substitution which subsequently become apparent.
5. Acknowledge acceptance of these provisions in request.

D. No verbal, or written approvals other than by Change Order will be valid.

1.6 SUBSTITUTION SUBMITTAL DATA

A. Complete data substantiating compliance of proposed substitution with Contract Documents.

B. For products:

1. Products identification, including manufacturer's name.
2. Manufacturer literature, marked to indicate specific model, type, size, and options to be considered:

a. Product description.
b. Performance and test data.
c. Reference standards.
d. Difference in power demand, air quantities, etc.
e. Dimensional differences from specified unit.

3. Full size samples if requested. Architect reserves right to impound sample until physical units are installed on project for comparison purposes. Requester pay all costs of furnishing and return of samples. Architect is not responsible for loss of, or damage to, samples.
4. Name and address of similar projects and name of Owner's representative we can contact, to discuss products, installation, and field performance data.

C. For construction methods:

1. Detailed description of proposed method.
2. Illustrate on drawings.

D. Itemized comparison of proposed substitute to specified item.

E. Data relating to changes in construction schedule.

F. Relation to separate contracts.

G. Cost of proposed substitution in comparison with product or method specified.

1.7 REJECTION OF SUBSTITUTION

A. Substitutions will not be considered if:

1. They are indicated or implied on shop drawings, or project data submittals, without formal request submitted in accord with this section.
2. Acceptance will require substantial revision of Contract Documents, or building spaces.
3. Request for substitution does not indicate specific item for which request is submitted. Acceptance of manufacturer only will not be made.

1.8 REIMBURSEMENT OF ARCHITECT'S COSTS

A. In the event substitutions are proposed to the Architect after the Contract has been awarded, the Architect will record all time used by him and by his consultants in evaluation of each such proposed substitution.

B. Whether or not the Architect approves a proposed substitution, the Contractor promptly upon receipt of the Architect's billing shall reimburse the Architect at the rate of two and one-half times the direct cost to the Architect and his consultants for all time spent by them in evaluating the proposed substitution.

END OF SECTION 012500

SECTION 012663 - FEES FOR CHANGES IN THE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this section.

1.2 REQUIREMENTS

A. Fees shall be indicated in the Proposal as a percentage of the actual net cost to the Prime Contractor of the following:

1. Changes in work performed by a Prime Contractor's own forces (15%).
2. Changes in work performed by a subcontractor's forces (10%).

B. Separate fee percentage is required for application to net increases or decreases in cost to the Contractor; fees shall include all charges for supervision, coordination, overhead, administration, bonds and profit.

C. Taxes, social security payments, insurance charges and similar assessments shall be computed separately and shall not be included in the cost of the work to which the fee is applied.

D. Fees shall not be applicable to adjustments made on the basis of "Unit Prices" stated in the Proposal Form.

END OF SECTION 012663

SECTION 012900 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for application for payment as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See General Conditions and Supplementary Conditions for additional general requirements.

1.2 SUBMITTALS

A. Project data, include the following:

1. Submittals: Prior to commencement of work.

a. Certificate of Insurance
b. Performance Bond (AIA Document A311).
c. Labor/Material Bond (AIA Document A311).
d. Schedule of Values (including names and contact telephone numbers for all sub-contractors). Include with AIA Document A101 submittal.

2. Submittals: Monthly, following commencement of work.

a. Four (4) copies of Application for Payment (AIA Document G702/G703). Application must be received by the Architect no later than the 25th of the month.
b. Sworn Statement, and Waivers of Liens (submit originals only) for the previous pay application. (No payment will be processed without all required waivers.)
c. The Contractor must submit electronic rough drafts of each Application for Payment to the Architect for review prior to originals being submitted.

3. Submittals: Prior to final application for payment.

a. All items required for project close-out including (but not limited to) the following:

1) Contractor’s written notice of substantial completion to Architect.
2) Certificates of governing authorities (including: inspection approvals and certificates of occupancy).
3) All warranties, guarantees, equipment operation and maintenance manuals, as-built drawings, attic stock (extra materials).
4) Completed, initialed punch list.

b. Reference specifications, section 01700 - Project Close-out, for additional information.

4. Submittals: Final

a. Application for Payment (AIA Document G702/G703).

b. Sworn Statement (submit originals only).
c. Waivers of Liens - Conditional/Unconditional (submit originals only).
d. Consent of Surety Form (submit originals only).

5. Submittals: Procedures for Processing

a. Contractor to submit all necessary documentation to Architect for review. Documentation shall be submitted by the 25th of the month.
b. The Architect shall have seven (7) days to review and process each Application for Payment correctly and completely submitted.
c. Applications for Payment submitted incorrectly or incompletely will be returned to the Contractor for correction/completion and resubmittal.
d. Owner will make payment to Contractor by the 15th of the following month. If application is late, received after the 25th of a month, payment will be made within 30 days from date submitted.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Submittal time schedule of Applications for Payment to be by the 25th of the month.

B. Notarize Application for Payment.

C. Provide supporting data substantiating Contractor's right to payment as Owner and Architect may require.

D. Submit Application for Payment on AIA Documents G702, Application and Certificate for Payment, and G703, Continuation Sheet.

E. Furnish in triplicate each document submitted.

F. Applications for Payment to serve as certification of status of project.

G. Signed by duly authorized agent of the Contractor.

H. Base application for payment upon 100 percent of value of work installed and materials and equipment suitably stored at site and materials and equipment suitably stored off site in insured and/or bonded warehouse.

I. Itemize Applications for Payment:

1. Work in place to date, broken down per schedule of values.
2. Materials and equipment stored on site.
3. Materials and equipment stored off site. (Provide copy of paid invoice and insurance certificate.)
4. Total amount due to date.
5. Amount of previous application.
6. Amount due for this period.

3.2 SCHEDULE OF VALUES

A. Subdivide the Schedule of Values items into defined areas of the building, the value of said subdivisions shall be mutually agreeable to both the Owner and Architect.

B. Bond cost will be paid with 1st payment. The Contractor's overhead and profit shall be distributed into each Schedule of Values item in proportion to the value of said item to the total value of this contract. Equal monthly payment shall be made for General Conditions based upon the number of months the Contractor is scheduled to be on-site.

C. Where the Schedule of Values items is separated into a Labor Amount and a Material Amount, payments shall be made for materials delivered and suitably stored. Where the Schedule of Values item is not separated into a Labor Amount and a Material Amount, payments shall be made for materials upon installation. The Labor Amount shall include all estimated on-site installation costs (including labor, applicable taxes, insurance, fringe benefits, erection equipment, tools, and overhead/profit). The Material Amount shall include all estimated material and manufactured equipment costs (including delivery costs, applicable taxes, insurance and overhead/profit).

3.3 CERTIFICATES FOR PAYMENT

A. Architect will, within 7 days after receipt of Contractor’s Application for Payment, either issue signed/certified Certificate for Payment to Owner, with copy to General Contractor, for such amount Architect determines is properly due, or notify General Contractor of reasons for withholding Certificate, and request re-submission with revisions.

3.4 PROGRESS PAYMENTS/RETAINAGE

A. Owner will withhold 10 percent of each payment for all work in place until work is 50% in place (verified by Architect and presented to Owner for approval. Retainage may be reduced at the Owner’s discretion for the completion of the contract after 50%.

B. For all public projects subject to compliance with Michigan Compiled Laws P.A. 1980, no. 524, sections 125.1561 thru 125.1565: After the work is 50 percent in place, the retainage withheld may be lowered to 5 percent, provided project is on schedule with all work progressing in a satisfactory manner, and no other outstanding, specific concerns relating to the Contractor’s performance under the contract. For all projects not subject to compliance with MCL P.A. 1980, no 524, sections 125.1561 thru 125.1565: Retainage withheld shall remain at 10 percent until project is “substantially complete” (refer to specifications, section 01700 - Project Close-out for definition) at which time retainage withheld shall be reduced to 5 percent until completion of all Punch List items have been verified/certified by the Architect and Owner as fully complete.

C. Owner will make monthly partial payments to Contractor within fifteen (15) days after receipt of Certificate for Payment from Architect.

3.5 SUBSTANTIAL COMPLETION

A. Within 30 days after Certificate of Substantial Completion (AIA Document G704) has been issued, Contractor will be paid sum sufficient to increase total payments to 100 percent of Contract Amount, less such retainage Architect deems necessary to protect Owner.

3.6 FINAL COMPLETION AND FINAL PAYMENT

A. Final payment constituting entire unpaid balance of Contract amount will be paid by Owner to Contractor within 30 days after final Certificate for Payment has been issued by Architect. The Owner reserves the right to make final payment to the Contractor prior to occupancy.

END OF SECTION 012900

SECTION 012976 - PAYMENT FOR DELIVERED MATERIALS AND EQUIPMENT

PART 1 - GENERAL - NOT USED

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PAYMENT FOR DELIVERED MATERIALS AND EQUIPMENT

A. Owner may make payments to Associated Contractor for materials and equipment ready, but not yet incorporated in the work, delivered and suitably stored at site or another location approved in writing by Owner’s Representative.

1. For purpose of above paragraph, "materials and equipment" eligible for payment are defined as finished goods made specifically for subject job and requiring extensive time to be manufactured or obtained. Raw materials or work-in-process at manufacturer's plant are not eligible for payment. Items which are readily available for purchase will not be considered eligible.

B. Payment by Owner for such materials and equipment not yet incorporated in the Work will be made provided following is accomplished:

1. Items must be listed separately on Application for Payment.
2. Provide receipted invoices as evidence that Prime Contractor is unconditional owner of equipment or material with Application for Payment.
3. Execute transfer to title, attached with each request.
4. Describe method used to store off-site items.
5. Identify items in storage as property of Owner, and furnish description of identification method.
6. Provide written inventory of items and methods used to verify such inventory, including Associated Contractor certification that all quantities have been received in good condition.
7. Owner must approve location of off-site storage, in writing.
8. Secure proof of insurance in Owner's name, at no additional cost to Owner.
9. Satisfactory proof of adequate transportation of items to site.

C. Owner retains right to verify storage by physical inspection prior to invoice approval and at any time thereafter. Such payment does not relieve responsibility for protecting, safeguarding, transporting and proper installation of equipment or materials. Warranty and guarantee period does not commence until installation and Substantial Completion of work.

D. Payment will be treated same as "work-in-place" with payment due upon evidence of delivery to job site or other location acceptable to Owner except that these payments will not be included in value of work in place for payment of labor and mark-up. Each subsequent invoice will restate prior month's materials and equipment not incorporated in the work and current month additions and deletions for materials and equipment incorporated into the Work.

E. Upon making of partial payments by Owner, all materials and equipment covered thereby become sole property of Owner. Partial payments, however, do not constitute acceptance of work by Owner, nor be construed as waiver of any right or claim by Owner.

END OF SECTION 012976

SECTION 013113 - COORDINATION OF WORK BY OTHERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Contractor shall be responsible for coordinating his work effort with the local utilities' companies for installation of new gas service, electric service, and water/sanitary systems. Refer to Cash Allowances Section 012113.

2. Contractor shall be responsible for coordinating his work effort with the Owner's Contractor for computer data systems and telephone systems.

3. Contractor shall be responsible for coordinating his work effort with the Owner's Contractor for Interior Furnishings.

END OF SECTION 013113

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Contractor Schedule and Administer Project Meetings:

1. Prepare agendas.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Record minutes; include significant proceedings and decisions.
5. Distribute copies of minutes to participants.

B. Architect representative attend meetings to ascertain that work is expedited consistent with construction schedule and with Contract Documents.

1.2 PRE-CONSTRUCTION MEETING

A. General Contractor schedule and hold pre-construction meeting prior to construction.

B. Attendance:

1. Owner.
2. Architect and his consultants.
3. General Contractor
4. Subcontractors.

C. Subcontractors must be prepared to discuss following items on minimum agenda prepared by General Contractor:

1. Distribute and discuss:

a. List of Subcontractors.
b. Tentative Construction Schedule.

2. Critical work sequencing.
3. Relation and coordination of subcontractors.
4. Designation of responsible personnel.
5. Processing of field decisions and change orders.
6. Adequacy of distribution of Contract Documents.
7. Submittal of shop drawings, project data and samples.

a. submittal log
- Itemized list of submittals (in CSI order)
- Date of Issue
- Date of Return
- Approved/Not Approved/Approved as Noted

8. Procedures for maintaining record documents.
9. Use of premises:

a. Office and storage areas.
b. Owner's requirements.

10. Submission and processing of monthly application for payment forms and associated requirements.

1.3 PROGRESS MEETINGS

A. Attend regularly scheduled meetings; time, day and place determined by General Contractor.

B. Hold called meetings as progress of work dictates. Generally, meetings will be held bi-weekly.

C. Location of meetings, at job site or as indicated in notice.

D. Attendance:

1. Owner.
2. Architect and his consultants.
3. General Contractor.

E. Minimum Agenda For Each Progress Meeting:

1. Review, approve minutes of previous meeting.
2. Review work progress since last meeting.
3. Note field observations, problems and decisions.
4. Identify problems which impede planned progress.
5. Review off site fabrication problems.
6. Review revised construction schedule.
7. Develop corrective measures and procedures to regain planned schedule, if required.
8. Plan progress during next work period.
9. Coordinate projected progress with other subcontractors.
10. Review submittal schedules and updated submittal log, expedite as required to maintain schedule.
11. Review RFI’s/outstanding issues.

END OF SECTION 013119

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Immediately after Contract award, prepare and submit progress schedule of work consistent with Contract Documents as herein specified.

B. Coordinate Subcontractor's schedules for entire project.

1. Resolve conflicts among schedules of Subcontractors.
2. Revise as required by conditions and progress of work.
3. Furnish copy of schedule for entire project to each Subcontractor.

1.2 SUBMITTALS (See Section 013400)

A. Initial construction schedule to Owner and Architect prior to start of work, but not later than date set for preconstruction conference.

B. Revised construction schedule to Owner and Architect prior to start of work but not later than 15 days after notice to proceed.

C. Updated schedules accurately depicting progress to last day of each month with Progress Report.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 FORMS OF SCHEDULES

A. Prepare in form of computer generated CPM. (Critical Path Method)

1. Order: Table of contents from Project Manual or Chronological order or beginning and completion of each item of work, whichever is most applicable.
2. Identify each task:

    a. By major specification number.
    b. By distinct graphic delineation.

3. Horizontal time scale: Identify first week day of each week.
4. Scale and spacing: To allow space for updating.

B. Sheet size: Maximum 8-1/2 x 14 IN.

3.2 CONTENT OF SCHEDULES

A. Provide complete sequence of construction by activity.

1. Shop drawings, product data and samples.

    a. Submittal dates.
    b. Dates reviewed copies will be required.

2. Decision dates for:

    a. Products specified by allowances.
    b. Selection of finishes.

3. Product procurement and delivery dates.
4. Dates for beginning, and completion of each element of construction.

B. Identify work separate phases, or other logically grouped activities.

C. Show project percentage of completion for each item of work as of last day of every month.

D. Provide separate sub-schedule showing submittals, review times, procurement schedules, and delivery dates.

E. Provide sub-schedule to define critical portions of entire schedule.

3.3 UPDATING

A. Show all changes occurring since previous submission of updated schedules.

B. Indicate progress of each activity, show completion dates.

C. Include:

1. Major change in scope.
2. Activities modified since previous updating.
3. Review projections due to changes.
4. Description of revision.

    a. Effect on schedule due to change in scope.
    b. Revisions in duration of activities.
    c. Other changes that may affect schedule.

D. Provide narrative report including:

1. Discussion of problem areas including current and anticipated delay factors and their impact.
2. Corrective action taken or proposed and its effect.
3. Effect of change in schedule of subcontractors.
4. Description of revisions.

    a. Effect on schedule due to change of scope.
    b. Revisions in duration of activities.
    c. Other changes that may affect schedule.

3.4 DISTRIBUTION

A. Distribute copies of revised schedules to:

1. Owner.
2. Architect.
3. Subcontractors.
4. Job Site File.
5. Other Concerned Parties.

B. Instruct recipients to report any inability to comply and provide detailed explanation, with suggested remedies.

END OF SECTION 013200

SECTION 013229 - PROGRESS REPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Project Data:

1. Progress reports.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.1 GENERAL

A. Each Contractor prepare comprehensive daily log and maintain it during entire project period.

B. Each Contractor present copy of daily log to Architect for compilation into monthly Progress Reports.

C. Each Contractor to present copies of their Progress Reports with Application for Payment.

D. Progress reports to include following data for each day of entire project period:

1. Manpower, by trade.
2. Work being performed, with location.
3. Weather.
4. Situations or circumstances liable to delay work or give cause for claims for time extension or added cost.
5. List of visitor’s names, to include officials, Owner’s representatives, and other authorities. Record their observation.

END OF SECTION 013229

SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES AND PROJECT DATA

PART 1 - GENERAL

1.1 DESCRIPTION

A. General

1. Furnish all labor, materials, tools, equipment, and services for furnishing, processing, delivery, reproduction and other functions for scheduling and handling of shop drawings, product data, samples and project data as indicated, in accord with Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for completion of work under this section.

B. See General Conditions for additional requirements.

C. See technical sections for data required.

1.2 SHOP DRAWINGS, PRODUCT DATA, SAMPLES AND PROJECT DATA - GENERAL

A. Contractor shall submit all items to CHMP, Inc. (electronic format is preferred) for review and approval.

B. Contractor shall submit all items to:

1. By mail: CHMP, INC.
   5198 Territorial Road
   Grand Blanc, MI 48439
   ATT: Carroll Strange
2. Or submit electronically to: cstrange@chmpinc.com
   cc: gmason@chmpinc.com

Note: All samples and color charts must be mailed.

C. Contractor is responsible for making all submissions.

1. Submit to address indicated.
2. Transmit all items with a transmittal form.

D. Provide all information required for complete review of each item in one submittal.

E. Make submittals sufficiently in advance of date required to allow Architect reasonable time for review, and resubmission, if necessary.

1. Items not submitted in accord with provisions of this section will be returned, without action, for resubmission.
2. Submissions on items not approved for use by specifications, addenda, or change order will be rejected.

1.3 SHOP DRAWINGS AND PRODUCT DATA SUBMITTALS

A. Shop drawing and product data submittals are required as called for by submittal paragraph specification section.

B. Identify drawings with manufacturer, item, use, type, project designation, specification section or drawing detail reference.

C. Submit drawing until review is complete.

1. Submit drawings not larger than 24 x 36 IN.
2. Allow clear space, approximately 40 SQ IN, for stamping on right hand side.

D. Mailed copies must be as follows: Contractors shall submit 7 copies of standard items such as equipment brochures, cuts of fixtures, or standard catalog items.

1. Indicate exact item or model and all proposed options.
2. Include scale details, sizes, dimensions, performance characteristics, and other pertinent data.

1.4 SAMPLE SUBMITTALS

A. Identify samples with manufacturer's name, item, use, type, product designation, specification section or drawing detail reference, color, range, texture, finish and other pertinent data.

B. Submit samples to address indicated.

1. Include brochures, shop drawings and installation instructions, if required, with transmittal.
2. Submit transmittal for site-built samples to address listed above.

C. Architect may, at his option, retain samples for comparison purpose until completion of work.

1. Samples will be returned or may be used in the work unless technical section specifically indicates otherwise.
2. Remove samples when directed.
3. Pay all costs of furnishing, constructing, and removing samples.

1.5 PROJECT DATA SUBMITTALS

A. Submit project data as indicated in individual sections.

B. If submittal does not comply with Contract Documents, Architect will so inform the Contractor. Contractor resubmit until no further objection is made.

C. Use of transmittal form not required.

1.6 CONTRACTOR ACTION: SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Review, approve and stamp all items prior to submission to General Contractor and Architect.

B. Stamp must indicate that Contractor has:

1. Verified all field dimensions and quantities.
2. Verified all field construction criteria, materials, catalog numbers and similar data.

3. Reviewed and coordinated all submittal data with requirements of the Work and Contract Documents.
4. Certified that submittals comply with Contract Documents.

C. Reproduce and distribute submittals receiving "approved" or "approved as corrected" stamp.

D. Resubmit items stamped "revise and resubmit" or "not approved".

1. Provide print of previous drawings with resubmission for comparison.
2. Add letter suffix to previous transmittal number, to indicate resubmission.

1.7 SUBMITTALS

A. Project data:

1. Submittals: Prior to first application for payment.

a. Product list.
b. Schedule of submittals.

1.8 PRODUCT LIST

A. Complete list of products and subcontractors proposed for use.

B. Only products and manufacturers which have been specified or approved by addendum may be used.

C. Partial payment request will not be processed until satisfactory project list has been received.

D. Format for project list:

1. Specification section.
2. Product.
3. Manufacturer.
4. Subcontractor.

1.9 SCHEDULE OF SUBMITTALS

A. Complete schedule of all required submittals indicating proposed submittal dates for all items.

1. Include all shop drawings, project data, samples and project data.

B. Schedule all submittals requiring color selection by Architect during First Quarter of construction period.

C. Schedule all submittals requiring Architect approval during first quarter of construction period.

D. Partial payment request will not be processed until satisfactory schedule of submittals is received.

1.10 ARCHITECT APPROVAL: SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Approval is only for conformance with the design concept of the project and compliance with the intent of the information given in the Contract Documents. Contractor is responsible for dimensions to be

confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction and for coordination of the work of all trades.

B. Approved samples, submitted or constructed, constitute criterion for judging completed work. Work or items not equal to samples will be rejected.

C. Start of work which requires submittals, prior to return of submittals with Architect's stamp indicating approval is at Contractor's risk.

END OF SECTION 013323

SECTION 015213 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General

1. Furnish all labor, materials, tools, equipment, and services for all temporary facilities and their subsequent removal as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work specifically indicated.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.2 COLD WEATHER PROTECTION

A. Provide all temporary heating during construction period, prior to completed installation of new H.V.A.C. system as required.

1. Operate system, furnishing necessary labor and supervision.
2. Maintain temperature of spaces where concrete is being placed or cured at not less than 50 degF (10 deg C).
3. Maintain interior temperature of not less than 70 degF (21 degC) for at least 7 days prior to, during placement of interior finishes, and after finishing until substantial completion.

B. Associated Contractor pay for all fuel used for temporary heat.

C. Extend warranty or guarantee period on permanent systems used during construction period to commence on date of substantial completion.

D. Use heat devices complying with codes and ordinances (note contractor is not permitted to use permanent heating system for temporary heating unless approved by the architect)

1.3 TEMPORARY ELECTRICITY

A. Make arrangements for and install equipment, poles, meter, wiring, switches, outlets, etc., to provide 480V and 120V power for all lighting and power requirements for construction as required.

1. Permanent building power distribution system may be used once it is installed with fees paid by the Owner.
2. Remove all temporary electrical equipment, poles, meter, wiring, switches, outlets, etcs., when no longer needed.
3. At completion of work, remove and replace all parts of permanent systems damaged.

B. Temporary electrical power used will be paid for by Owner.

C. Each Contractor provide his own extension cord.

D. Each Contractor provide heavy duty electrical power, exceeding available power, required for his operation.

1.4 TEMPORARY WATER

A. Contractor shall be required to make all necessary arrangements to provide temporary water to the site for construction.

B. The cost of the temporary water will be paid for by the Contractor.

1.5 TEMPORARY TOILETS

A. Contractor to provide temporary toilet facilities for use of all workmen.

1. Provide facilities complying with Local, State and Federal Sanitary Laws and Regulations.
2. Maintain in clean, sanitary condition.
3. Provide adequate supplies of toilet paper.

1.6 CONTRACTORS FIELD OFFICE

A. Contractor to provide field office and telephone service for his use and use of Architect. Note: Existing building may be used as the field office.

1. Pay for all local telephone service.
2. Long distance calls paid for by person placing call.
3. Field Office shall be of sufficient size (as determined by Architect) to allow comfortable seating at a table with chairs for 12.
4. Provide heat and lighting in Field Office and have capability to send and receive either faxes or emails.

1.7 TEMPORARY ENCLOSURES

A. Furnish and install temporary enclosures, doors, and transparent plastic windows required to protect building from damage due to vandalism, or the elements, or to maintain suitable temperature during installation or finishing work. Temporary enclosures shall be provided at Owner’s direction.

B. Provide all items required in connection with safety program.

1.8 TEMPORARY STORAGE AND WORKING AREAS

A. Prior to start of work, General Contractor shall meet with all contractors to arrange and prepare plot plan defining working, storing and traffic areas.

1. Except as specifically provided, working and storing outside these areas will not be permitted.
2. Arrange and locate temporary structures and sheds to avoid interfering with construction.

B. Within area designated for his use, each Contractor provide suitable and sufficient enclosed and covered spaces, with raised flooring, to protect materials and equipment from damage by weather or construction work.

1. Maintain storage and working areas in clean and orderly condition. Each trade responsible for cleaning as a result of their work.

2. Upon completion of work, or sooner if directed by Architect, remove temporary structures and leave in clean and orderly condition.

1.9 TEMPORARY FENCES AND BARRICADES

A. Furnish, install and maintain all necessary sound temporary fences, barricades, trench and hole covers, warning lights and all other safety devices necessary to prevent injury to persons and damages to property.

1.10 PROJECT SIGNS

A. Limit signs on site except those of General Contractor, Mechanical Contractor, Electrical Contractor and/or Architect/Engineer.

1. Post no other signs on site except those required by law and/or approved by Architect.
2. Upon completion of the work, or sooner if decided, remove project sign.
3. Locate signs on site where directed by Architect.

B. Furnish and install one project sign at each site.

1. Sign:

a. Size: 4 x 8 ft.
b. Material: Metal or wood frame, with 5/8 or ¾ in. thick MDOT exterior grade plywood surface.
c. Support two 4 x 6 in. x 12 ft. treated wood posts, properly braced, set approximately 4 ft. in earth and with bottom of sign approximately 4 ft. above grade.
d. Text to show name of Owner, Architect/Engineers and General Contractor.
e. Paint all surfaces of sign and frames with two coats of exterior enamel paint and letter thereon as detailed by Architect.

1.11 ACCESS ROAD

A. Provide access on building site as required to accomplish the work.

B. Clean up on debris, materials, etc., that fall from vehicles enroute to and from site.

1.12 TRAFFIC CONTROL

A. Provide any traffic control deemed necessary to effect smooth Owner operations.

END OF SECTION 015213

SECTION 016000 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, work and services for delivery, receiving, handling, storage and protection of materials and equipment.
2. See technical sections for additional requirements.
3. Completely coordinate with work of other trades.
4. Although such work is not specifically indicated, furnish all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.2 JOB CONDITIONS

A. Comply with applicable codes.

B. Accomplish work to avoid damage to property.

C. Clean debris from streets and walks.

D. Provide fire protection.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY

A. By manufacturer's normal means.

B. In original labeled containers.

C. Where applicable, with U/L labeling on packages.

D. Contractor responsible for acceptance at site.

E. Schedule deliveries to avoid delaying work.

F. Inspect items for damage upon delivery, reorder as required to avoid delays.

3.2 PRODUCT HANDLING AND STORAGE

A. Use methods to avoid damage to item or structure.

B. Protect weather fragile items from weather damage.

C. Handle and store bulk aggregates to avoid contamination.

D. Store to allow air circulation.

E. Store only in authorized areas on site.

F. Replace or repair damaged items.

G. Protect installed items as required until acceptance of building.

H. Uncrate, assemble, if required, and remove debris.

I. When offsite storage is authorized, perform rehandling to move items to site at no added cost.

3.3 CLEANUP

A. Remove excess materials from site.

B. Turn over to Owner, excess materials scheduled to remain.

C. Restore site storage areas as directed by Architect.

END OF SECTION 016000

SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment and services for all cutting and patching as indicted, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See Division 1 for additional General Requirements.

1.2 SUMMARY

A. Install work in such a manner and sequence as to preclude or minimize cutting and patching of new work.

B. Execute cutting (including excavation) fitting or patching of work required to:

1. Make several parts fit properly.
2. Uncover work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace non-conforming work.
5. Remove samples of installed work for testing.
6. Install specified work in existing construction.

C. In addition to contract requirements, upon written instructions of Architect:

1. Uncover work to provide for Architect’s observation of covered work in accord with Contract Documents.
2. Remove samples of installed materials for testing in accord with Contract Documents.
3. Remove work to provide for alteration of work in place.

D. Do not endanger any work or any work of other contractors, by cutting, excavating, or other wise altering any work except with written consent of Owner Representative subject to review by Architect.

E. Do not cut into or cut away any structural members, no dig under any foundations or into walls or other parts, or in any case allow same to be done without full knowledge and written consent of Architect. Be responsible for damage resulting from violation of these provisions.

F. Use only firms or individual trades qualified to perform work required under this section.

1.3 JOB CONDITIONS

A. Perform preliminary investigations as required to ascertain extent of work. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.

B. Before start of work, obtain and pay for all permits required by all authorities having jurisdiction and

notify all interested utility companies.

1.4 PAYMENT FOR COSTS

A. Costs caused by ill timed or defective work, or work not conforming to Contract Documents, shall be paid by contractor responsible for ill timed, rejected or non-conforming work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For patching of work provide matching items. Where applicable, comply with specifications for type of work to be done.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of work, including elements subject to movement or damage during:

1. Cutting and patching.
2. Excavating and backfilling.

B. After uncovering work, inspect conditions affecting installation of new products.

3.2 PREPARATION PRIOR TO CUTTING

A. Provide shoring, bracing and support as required to maintain structural integrity of project.

B. Provide protection for other portions of project which may be affected.

C. Provide protection from elements when required.

3.3 CUTTING AND REMOVAL - GENERAL

A. Execute fitting and adjustment to provide finished installation to comply with specified tolerances and finishes.

B. Execute cutting by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs to new work.

C. Perform backfilling as specified in applicable sections.

D. Neatly cut and remove materials, and prepare all opening to receive new work.

E. Remove masonry or concrete in small sections.

F. Provide shoring, bracing, and other supports to prevent movement, settlement or collapse of remaining or adjacent wall areas, structure, or facilities. Arrange shoring, bracing, and supports to prevent overloading

of structure.

G. Take all precautions necessary to prevent damage to existing remaining work or to adjacent facilities. Execute work using methods which will prevent interference with use of remaining and adjacent facilities by Owner.

H. Remove existing work indicated to be removed, or as necessary for installation of new work.

3.4 MATCHING AND PATCHING

A. Where items are removed from existing walls, ceilings, floors or partitions to remain, infill and repair wall, ceiling, floor or partition disturbed by removal with materials matching adjacent condition. Contractor will be responsible for reviewing construction plans with existing conditions for verification of patching work extent.

B. Where walls, ceilings, floors or partitions are removed, repair abutting walls, ceilings or floors disturbed by removal.

C. Where existing construction is cut or otherwise disturbed to permit installation of new work, match and patch existing disturbed construction.

D. Use methods and materials similar in appearance, and equal in quality to areas or surfaces being repaired.

E. Materials and finished work are subject to review and approval of Architect.

F. Remove and replace areas, surfaces or items which cannot be satisfactorily matched and patched.

G. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents. Patch work shall in every way possible match existing work and/or adjacent surfaces.

H. Finish entire surfaces as necessary to provide an even finish.

1. Continuous surfaces; to nearest intersections.
2. Assembly - entire refinishing.

3.5 CLEAN UP

A. Remove all debris, rubbish, and materials resulting from cutting demolition or patching operations.

B. Transport materials and legally dispose of off site.

END OF SECTION 017329

SECTION 017413 - CLEANING UP

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for cleaning up required in conjunction with work performed, as indicated or required, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. Each Contractor is responsible for daily clean up and removal of his contract's debris, trash, construction waste.

1.2 FIRE PROTECTION

A. Store volatile waste in covered metal containers.

B. Remove from premises daily.

1.3 POLLUTION CONTROL

A. Conduct clean-up and disposal operations to comply with local ordinances and anti-pollution laws.

B. Do not burn or bury rubbish and waste on site.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Use materials recommended by manufacturers of surfaces to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Clean all items installed under this Contract.

1. Leave free of stains, damage, or other defects prior to final acceptance.
2. Include cleaning of all finished wall surfaces, floors, hardware, lighting fixtures and items of Architect, to his satisfaction at no additional expenses to Owner.

B. See technical sections for additional cleaning requirements.

3.2 DURING CONSTRUCTION

A. Each Contractor shall clean up his waste materials, rubbish, and debris resulting from his scope of work daily or at such frequencies as required by Owner.

B. Ensure that building and grounds are maintained free from accumulations of debris.

C. Sprinkle dusty debris with water.

D. At reasonable intervals, minimum once a week, clean-up site and access and dispose of debris off site.

E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior surfaces of fixtures, hardware, and equipment.

F. Repair, patch and touch-up marred surfaces to match adjacent finishes damaged by his own operations.

G. Comply with additional requirements defined in specifications.

H. Vacuum interior areas when ready for painting.

I. Schedule cleaning operations so that contaminants resulting from cleaning do not fall on wet painted surfaces.

J. Clean all glass and aluminum surfaces within work area.

K. Leave the work "broom clean".

3.3 FINAL CLEANING

A. Use experienced workmen or professional cleaners for final cleaning.

B. At completion of construction, just prior to acceptance or occupancy. Each contractor to perform final cleaning of his scope of work. Architect shall inspect for approval and acceptance.

C. Remove dirt, stains, labels, and foreign materials.

D. Repair and touch-up marred areas.

E. Broom clean paved surfaces; rake clean other surfaces of grounds; vacuum, polish and mop floors.

END OF SECTION 017413

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. GENERAL:

1. Furnish all labor, materials, tools, equipment and services for project closeout as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See General Conditions and Supplementary Conditions for additional general requirements.
5. See technical sections for specific submittal items.

1.2 SUBMITTALS

A. Project data:

1. For substantial completion:

a. List of all items to be completed or corrected.
b. Written notice of substantial completion.
c. Certificates of governing authorities.
d. Initialed punch list.

2. For final completion:

a. Written certification that work is complete.
b. Evidence of payments and release or waiver of liens.

(1) Contractor's Affidavit of Payments of Debts and Claims.
(2) Contractor's release or waiver of liens.
(3) Separate releases or waivers of liens for subcontractor suppliers, and other with lien rights against Owner, together with list of all such parties.

c. Final application for payment (AIA G702 and G703).
d. List of all sales and services taxes.
e. Letter of site conformance.

1.3 FOR SUBSTANTIAL COMPLETION

A. Obtain evidence of compliance with requirements of governing authorities.

1. Certificates of inspection of:

a. Electrical
b. Mechanical
c. Plumbing

2. Other authorities as required.
3. Certificate of occupancy.

B. Submit written notice, including list of all items to be completed or corrected, which state that Project, or designated portion thereof, is substantial complete.

C. Architect will, within reasonable period after notification, review the work and list of items to be completed or corrected, and revise or add to list if necessary.

D. If Architect does not agree that Work is substantially complete:

1. They shall immediately notify Contractor in writing, stating reasons.
2. Contractor must substantially complete Work and submit second written notice, including list of items to be completed or corrected, that Project, or designated portion thereof, is substantially complete.
3. Architect will again review the Work is substantially complete.

E. If Architect agree that work is substantially complete:

1. Architect will prepare punch list of project, or designated portion thereof, and will provide one copy each to Contractor and Owner.
2. Architect will return revised list of items to be completed or corrected, and punch list to Contractor.
3. Architect will prepare Certificate of Substantial Completion, AIA G-704, accompanied by revised list of items to be complete or corrected and punch list.
4. Owner may occupy Project, or designated portion thereof, at this time, under provisions stated in Certificate of Substantial Completion.

F. If Owner is going to occupy Project, or designated portion thereof, each Contractor must perform final cleaning.

G. Each Contractor shall complete work listed for completion or correction and all punch list items, within designated time, and return both lists with each item initialed and dated to indicate completion.

1.4 FOR FINAL COMPLETION

A. Submit written certification that:

1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested and are operational.
5. Project is complete in every respect.

B. Architect will make final walk through within ten (10) days after receipt of certification.

C. Each Contractor shall remedy any remaining deficiencies, and submit final closeout submittals.

D. Should final completion be materially delayed through no fault of Contractor. Contractor may submit application for payment for portion of work on punch list which has been completed, in accord with provisions of General Conditions.

E. Upon completion of project, before final payment, furnish Owner, in number of copies required by Owner, certified list of all sales and services taxes paid by each Contractor (and subcontractor) in execution of the Contract.

F. Upon completion of project, before final payment, furnish Owner all required warranties and guarantees.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all operating and maintenance manuals as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See Division 1 for General Requirements.

1.2 PRESENTATION OF SUBMITTALS

A. Operation and maintenance manuals for each product, components and system indicated. Submit 3 copies at least 60 days prior to equipment instruction period. See Section 017350.

B. Maintenance data to Owner for finish materials indicated.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE MANUALS

A. Assemble data indicated and other data required to completely describe operation and maintenance procedures.

B. Bind or assemble in ring-binders, completely indexed by specification section, with each item clearly labeled.

C. Identify each item in manner consistent with names and identification numbers used in Contract Documents, not with manufacturer's catalog numbers.

D. Neatly type or draft all data not furnished in printed form.

E. Organize data for ease of reference.

2.2 DATA REQUIRED FOR EACH COMPONENT AND SYSTEM

A. Sequence of operation:

1. List valves, switches, etc., used to start, stop and adjust systems.
2. Provide flow diagrams, control sequences and valve directory.
3. Submit valve directory for review prior to inclusion in manual: Show valve number, location. List equipment controlled.

B. Lubrication instruction:

1. Frequency of inspection and lubrication recommended.
2. Type of grease.
3. Lubrication recommended.

C. Maintenance and trouble-shooting data:

1. All manufacturer furnished data.
2. Project record wiring diagrams.
3. Name and address of manufacturer.
4. Name and address of local representatives who stock or distribute repair parts.

2.3 DATA REQUIRED FOR FINISH MATERIALS

A. Maintenance data.

1. Precautions necessary.
2. Manufacturer's instructions and recommendations.
3. Maintenance materials and tools required.
4. Repair and/or replacement instructions.
5. Name and address of manufacturer.
6. Name and address of local supplier of maintenance materials.

PART 3 - EXECUTION

3.1 DELIVERY

A. Deliver all items to Owner at time of final completion.

1. Submit 3 copies at least 60 days prior to equipment instruction periods (See Section 01735).
2. Resubmit and/or submit additional data as directed by Architect.

B. Have copies of required manuals available during instruction of Owner's personnel.

END OF SECTION 017823

SECTION 017825 - OWNER INSTRUCTION FOR EQUIPMENT AND SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all equipment demonstration and Owner personnel instruction as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

B. Provide instruction for all equipment and systems for which operating and maintenance data is required. See individual sections.

1.2 QUALITY ASSURANCE

A. Instructors: Member(s) of installers' staffs and authorized representative(s) of component, assembly, or system manufacturer(s). See individual sections for additional requirements.

1.3 PRESENTATION OF SUBMITTALS

A. Submit separate report for each system or type of equipment, subject to Owner's approval.

1. Submit report (form attached) with preliminary information indicated, to Owner’s Representative at least 2 weeks prior to first instruction period.
2. Submit completed report; one copy each to Owner’s Representative and Architect.

1.4 JOB CONDITIONS

A. Complete all instructions prior to Substantial Completion.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not begin instructions until component, assembly or system has been tested as specified and is in satisfactory operating condition.

B. Assemble instructional aids.

1. Have operation and maintenance data available for use during instruction (See Section 01730).

3.2 INSTRUCTION

A. Instruct Owner's personnel in operation and maintenance of equipment and systems.

1. Provide all necessary instruction to satisfaction of Owner.

B. Explain use of operating and maintenance manuals.

C. Tour building areas involved and identify:

1. Maintenance points and access.
2. Control locations and equipment.

D. Explain operating sequences.

1. Identify location and show operation of switches, valves, etc., used to start, stop and adjust systems.
2. Explain use of flow diagrams, operating sequence diagrams, etc.
3. Demonstrate operation through complete cycle(s) and full range of operation in all modes, including testing and adjusting relevant to operation.

E. Explain use of control equipment, including temperature settings, switch modes, available adjustments, reading of gages, and functions that must be serviced only by authorized factory representatives.

F. Explain trouble-shooting procedures.

1. Demonstrate commonly occurring problems.
2. Note procedures which must be performed by factory personnel.

G. Explain maintenance procedures and requirements.

1. Point out items requiring periodic maintenance.
2. Demonstrate typical preventive maintenance procedures and recommended typical maintenance intervals.
3. Demonstrate other commonly occurring maintenance procedures not part of preventive maintenance program.
4. Identify maintenance materials to be used.

H. Furnish all tools required.

END OF SECTION 017825

SECTION 017836 - WARRANTIES AND GUARANTEES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide written guarantees for products and installations indicated.

B. See General Conditions and Supplementary General Conditions.

C. Provide guarantees for period(s) indicated.

D. Provide manufacturer's guarantees for products.

1. Where manufacturer's standard guarantees expire before expiration date required by Contract Documents, obtain and pay for guarantee extensions, as part of Contract Price.

E. Provide all guarantees prior to final acceptance.

F. Submit guarantees indicated, to the Owner’s Representative with copy of transmittal form to Architect.

END OF SECTION 017836

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services to provide record documents as specified, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. See Division 1 for additional General Requirements.

B. Definitions:

1. Documents required for construction: Complete set of all documents required by Contract Documents, including but not limited to:

a. Contract drawings.
b. Project manual/specifications.
c. Addenda.
d. Shop drawings.
e. Project data.
f. Samples and mock-ups.
g. Change orders.
h. Modifications.
i. Field test records.

2. Field documents: Complete set of all documents required for construction.

a. Used for construction of project.
b. Contract drawings in form of prints.

3. Periodic Update Documents: Complete separate set of all documents required for construction with exception of samples and mock-ups.

a. Not used for construction of project.
b. Contract drawings in form of clean prints.

4. Project Record Documents: Complete set of all documents required for construction with exception of samples and mock-ups.

a. Do not use for construction of project.
b. Provide contract drawings in form of correctable, reproducible sepia mylars.

1.2 SUBMITTALS (See Section 01340)

A. Project data:

1. Project record Documents, at completion of project, to Owner with letter of transmittal.

a. Submit Project Record Documents in containers used for periodic Update Documents.

2. Provide transmittal letter containing:

    a. Date.
    b. Project title.
    c. Contractor's name and address.
    d. Title and number of each Project Record Document.
    e. Certification that Project Record Documents submitted are complete and accurate.

3. Copy of transmittal letter to Architect.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 POSTING PRIOR TO CONSTRUCTION

A. After Contract is executed, but prior to start of construction, obtain Contract Drawings and Project Manual/Specifications which will be used for Field Documents and Periodic Update Documents.

B. Obtain copies of all addenda and post above documents.

3.2 MAINTENANCE OF FIELD DOCUMENTS

A. Maintain minimum of one copy at project site.

B. Label each document "FIELD".

C. These documents will be used of construction of project.

D. Make documents available at all times for review by Architect, Owner and authorities having jurisdiction.

3.3 MAINTENANCE OF PERIODIC UPDATE DOCUMENTS

A. Maintain one copy at project site.

B. Label each documents "PERIODIC UPDATE".

C. Do not use these documents for construction purposes.

D. Make documents available at all time for review by Architect, Owner and authorities having jurisdiction.

E. Maintain in clean, dry, legible condition.

F. Maintain contract drawings in stackable, enclosed cardboard file drawers designed to hold drawings horizontally.

    1. Provide index of contents of each file drawer on outside of drawer.
    2. This item to be at the Owner’s discretion.

G. Maintain all other Periodic Update Documents in stackable, enclosed file boxes designed to hold specific type of documents.

1. Provide index of contents of each box on outside of box.
2. This item to be at the Owner’s discretion.

3.4 POSTING AND UPDATING OF PERIODIC UPDATE DOCUMENTS

A. Post and update on weekly basis.

B. Contract drawings: Mark legibly to record actual construction including by not limited to:

1. Depths of various elements of foundations in relation to first floor level.
2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
4. Field changes of dimension and detail.
5. Changes made by change order or field order.

C. Project Manual/Specifications: Type on each section to record all changes including but not limited to:

1. Addenda.
2. Change order or field order.
3. Modifications to contract.
4. Bind added sections into Project Manual/Specifications.
5. Indicate manufacturer.

D. Do not conceal work for which information must be recorded until all required information is recorded on Periodic Update Documents.

E. Any work concealed prior to recording of required information will be exposed. Once all required information is recorded on Periodic Update Documents, work will be restored at Contractor's expense.

3.5 PRODUCTION OF PROJECT RECORD DOCUMENTS

A. At substantial completion, obtain complete set of correctable, reproducible mylars for each contract drawing.

B. Label each document "PROJECT RECORD".

C. Have skilled draftsman transfer all changes, corrections, entries, etc., from Periodic Update Documents to Project Record Documents.

D. All other Period Update Documents may be used for Project Record Documents provided they are in satisfactory condition.

E. Replace any Periodic Update Documents, found to be in unsatisfactory condition. Transfer all recorded changes from original to replacement copy.

END OF SECTION 017839

SECTION 017843 - SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all spare parts and maintenance materials as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See Division 1 for General Requirements.
5. See specification sections for items required.

1.2 PRESENTATION OF SUBMITTALS

A. Spare parts: To Owner’s Representative with letter of transmittal.

B. Maintenance materials: To Owner’s Representative with letter of transmittal.

C. Extra materials: To Owner’s Representative with letter of transmittal.

D. Copies of all letters of transmittal: To Architect.

PART 2 - PRODUCTS

2.1 SPARE PARTS AND TOOLS

A. Package in clearly identified boxes.

1. Indicate manufacturers name, part name and stock number.
2. Indicate piece of equipment part or tool is for.
3. Indicate name, address and phone number of closest supplier.

2.2 MAINTENANCE MATERIALS

A. Package in clearly identified boxes.

1. Indicate trade name and stock number.
2. Indicate which item material is to be used with.
3. Indicate name, address and phone number of closest supplier.

2.3 EXTRA MATERIALS

A. Package in clearly identified containers, or install where indicated.

1. Indicate trade name, stock number, size, color, etc.
2. Indicate where product is to be used.
3. Indicate name, address and phone number of closest supplier.

PART 3 - EXECUTION

3.1 DELIVER

A. Deliver to Owner‘s Representative at time of final completion unless Owner’s Representative requests earlier delivery.

END OF SECTION 017843

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Demolition and removal of selected portions of a building.
2. Repair procedures for selective demolition operations.

B. Definitions:

1. Remove: Detach items from existing construction and legally dispose of them.
2. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
3. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
4. Existing to Remain: Existing items of construction that are not to be removed.

1.2 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be salvaged, reinstalled or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at Contractor's option.

1.3 SUBMITTALS

A. Qualification Data: List of demolition firm's completed projects with project addresses, and names and addresses of architects and owners.

B. Proposed dust-control measures.

C. Proposed noise-control measures.

D. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of temporary partitions and means of egress.
5. Procedures to ensure uninterrupted progress of Owner's on-site operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

E. Inventory: Items to be removed and salvaged.

F. Photographs or Videotape: Before work begins, submit sufficiently detailed photographs or videotapes showing existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations.

G. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.4 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Firm shall be a Specialist in demolition work of similar materials and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with NFPA 241 and ANSI A10.6.

D. Pre-Demolition Conference: Conduct conference at Project site to comply with requirements in Division 1 section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by demolition operations.

1.5 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area.

1. Conduct selective demolition so Owner operations will not be disrupted.
2. Provide the Owner with not less than 72 hours notice prior to activities that will affect Owner operations.
3. Conduct all demolition activities during non-normal business hours.

B. Maintain access to existing walkways, corridors and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. On-site storage or sale of removed items or materials will not be permitted.

D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

E. Fire Protection: Maintain fire-protection services during selective demolition operations.

F. Provide temporary barricades and dust control measures to protect building occupants and to control migration of dust into occupied areas.

1.6 WARRANTIES

A. Existing Special Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials that do not void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Where available and appropriate for use, provide repair materials that are identical to existing materials.

B. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

C. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities to be removed have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled, and items to be removed and salvaged.

D. When encountering unanticipated mechanical, electrical or structural elements that conflict with the intended function or design, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Owner.

E. Survey the condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

F. Perform surveys as the selective demolition progresses to detect hazards resulting from the activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by authorities having jurisdiction.

1. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

2. Provide not less than 72 hours notice to the Owner if shutdown of service is required during changeover.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. Where utility services are required to be removed, relocated or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit after bypassing.
5. Do not start selective demolition work until utility disconnection and sealing have been completed and verified.

3.3 PREPARATION

A. Dangerous Materials: Drain, purge or otherwise remove, collect and dispose of chemicals, gases, explosives, acids, flammables or other dangerous materials before proceeding with selective demolition operations.

B. Pest Control: Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

C. Temporary Site Control: Remove debris and conduct demolition operations in a manner to ensure minimum interference with roads, streets, walks, walkways, corridors, and other adjacent occupied or used facilities.

1. Do not close or obstruct streets, walks, walkways, corridors, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Temporary Facilities: Conduct demolition operations in a manner to prevent injury to people and damage to adjacent building and facilities to remain. Provide for safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies and covered passageways, where required by authorities having jurisdiction.
2. Protect walls, ceilings, floors and other existing finish work that are to remain and are exposed during selective demolition operations.
3. Cover and protect furniture, furnishings and equipment that have not been removed.

E. Temporary Enclosures: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

F. Temporary Shoring: Provide and maintain shoring, bracing or other structural support to preserve stability and prevent movement, settlement or collapse of building to be selectively demolished. Strengthen or add new supports when required during the progress of selective demolition.

3.4 POLLUTION CONTROLS

A. Dust Control: Use temporary enclosures and other suitable methods complying with governing environmental protection regulations to limit the spread of dust and dirt.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding or pollution.
2. Wet mop floors to eliminate trackable dirt, and wipe down walls and doors of demolition enclosure.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Cleaning: Clean adjacent structures and site improvements of dust, dirt and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.5 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete selective demolition within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically. Conduct work in an order that avoids transporting removed items and debris through areas with completed selective demolition work, and that allows for removal of items before supports for those items are removed in another area.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage adjoining construction to remain. Use hand or small power tools designed for sawing or grinding, not for hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations, and maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested and other dangerous or unsuitable materials, and promptly dispose of these materials off-site.
6. Lower removed structural framing members to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
7. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors or framing.
8. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Existing Facilities: Comply with building manager's regulations for using and protecting stairs, walkways, loading docks, building entries and other building facilities during selective demolition operations.

C. Repair and Storage of Salvaged Items and Items to be Reinstalled:

1. Repair: Clean and repair the materials and equipment to functional condition adequate for intended reuse. Paint damaged or deteriorated painted surfaces of equipment to match new equipment.
2. Storage: Store the materials and equipment in a secure area until final disposal.

D. Disposal of Salvaged Items and Items to be Reinstalled:

1. Reinstallation: Where items are indicated to be removed and reinstalled, install the materials and equipment in locations indicated. Comply with installation requirements for new materials and equipment.
2. Delivery to Owner: Where items are indicated to be removed and salvaged, transport the materials and equipment to the area on-site designated by the Owner or indicated on the Drawings.

E. Protection of Salvaged Items: Pack or crate salvaged materials and equipment after removal. Identify contents of containers. Protect items from damage during transport and storage.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Owner, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

3.6 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to the manufacturer's written recommendations.

C. Finishes: Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

D. Floor and Wall Surfaces: Patch and repair floor and wall surfaces in each space where demolished walls or partitions result in extending one finished area into another. Provide a flush and even surface of uniform color and appearance.

1. Closely match texture and finish of existing adjacent surface.
2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the patched surface has received primer and other specified undercoats.
4. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
5. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

E. Ceilings: Patch, repair or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Refer to Section 01505 “Construction Waste Management” for disposal of demolished materials. Do not allow demolished materials to accumulate on-site.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Foundation, walls & footings.
2. Slabs-on-grade.
3. Equipment pads and bases.
4. Concrete hardeners/sealers.
5. Concrete reinforcing.

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

1. Division 32 Section "Portland Cement Concrete Paving" for concrete paving and walks.
2. Division 22 “Plumbing Fixtures” for trench drains embedded in Apparatus Room concrete floor slab.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Laboratory test reports for concrete materials and mix design test.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
3. ACI 318, "Building Code Requirements for Reinforced Concrete."
4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service: The General Contractor shall engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 420), deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

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

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

C. Lightweight Aggregates: ASTM C 330.

D. Water: Potable.

E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Air-Tite, Cormix Construction Chemicals.
b. Air-Mix or Perma-Air, Euclid Chemical Co.
c. Darex AEA or Daravair, W.R. Grace & Co.
d. MB-VR or Micro-Air, Master Builders, Inc.
e. Sealtight AEA, W.R. Meadows, Inc.
f. Sika AER, Sika Corp.

G. Water-Reducing Admixture: ASTM C 494, Type A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Chemtard, ChemMasters Corp.
b. PSI N, Cormix Construction Chemicals.
c. Eucon WR-75, Euclid Chemical Co.
d. WRDA, W.R. Grace & Co.
e. Pozzolith Normal or Polyheed, Master Builders, Inc.
f. Metco W.R., Metalcrete Industries.
g. Prokrete-N, Prokrete Industries.
h. Plastocrete 161, Sika Corp.

H. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. Use when temperature is 90EF+.

1. Products: Subject to compliance with requirements, provide one of the following:

a. PSI-R Plus, Cormix Construction Chemicals.
b. Eucon Retarder 75, Euclid Chemical Co.
c. Daratard-17, W.R. Grace & Co.
d. Pozzolith R, Master Builders, Inc.
e. Protard, Prokrete Industries.
f. Plastiment, Sika Corporation.

I. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Super P, Anti-Hydro Co., Inc.
b. Cormix 200, Cormix Construction Chemicals.
c. Eucon 37, Euclid Chemical Co.
d. WRDA 19 or Daracem, W.R. Grace & Co.
e. Rheobuild or Polyheed, Master Builders, Inc.
f. Superslump, Metalcrete Industries.
g. PSPL, Prokrete Industries.
h. Sikament 300, Sika Corp.

2.4 RELATED MATERIALS

A. Sand Cushion: Clean, manufactured or natural sand.

B. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyethylene sheet not less than 8 mils thick.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m), complying with AASHTO M 182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

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

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aquafilm, Conspec Marketing and Mfg. Co.
b. Eucobar, Euclid Chemical Co.
c. E-Con, L&M Construction Chemicals, Inc.
d. Confilm, Master Builders, Inc.
e. Waterhold, Metalcrete Industries.

F. Liquid Hardener/Sealer Compound: Clear liquid type curing compound complying with ASTM C 309, Type I, Class A.

1. Products:

a. Concrete hardener/sealer: Where exposed, interior concrete floor slabs are indicated on the Room Finish Schedule provide and install per manufacturers requirements; Ashford Formula, manufactured by Curecrete Chemical Company and distributed by Michigan Protective Coating Consultants, Inc., P.O. Box 39287, 15106 Beech Daly Road, Detroit, MI 48239, (313) 538-7878.

2. Vinyl Expansion material - pro flex as manufactured by OSCODA Plastics Inc. 800/ 544-9538. Vinyl expansion material shall be standard concrete colon.

G. Vinyl Expansion Material - Pro flex as manufactured by OSCODA Plastics Inc. 800/544-9538.

1. Vinyl expansion material shall be standard concrete color.

2.5 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.
2. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. 4000 psi, 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air-entrained), 0.35 maximum (air-entrained).
2. 3500 psi, 28-day compressive strength; water-cement ratio, 0.51 maximum (non-air-entrained), 0.40 maximum (air-entrained).
3. 3000 psi, 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained).

D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to freezing and thawing: W/C 0.45.
2. Subjected to deicers/watertight: W/C 0.40.
3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches (75 mm).
2. Reinforced foundation systems: Not less than 1 inch (25 mm) and not more than 3 inches (75 mm).
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2 - 3 inch (50 - 75 mm) slump concrete.
4. Other concrete: Not more than 4 inches (100 mm).

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

C. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2 inch (38 mm) maximum aggregate.
b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1 inch (25 mm) maximum aggregate.
c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4 inch (19 mm) maximum aggregate.
d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2 inch (13 mm)

maximum aggregate.

2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

D. Use admixtures for water reduction and set retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items.

Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended mastic or pressure-sensitive tape.

1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

C. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

D. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of

insert. After concrete has cured, remove inserts and clean groove of loose debris.

2. Contraction joints in floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding 15 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit

duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor

levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

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

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

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Steel Pan Stoops: Provide concrete fill for steel pan stoop and associated items. Screed, tamp, and broom-finish concrete surfaces.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.14 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous

locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Architect.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The General Contractor shall employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. (4 cu. m) plus additional sets for each 50 cu. yd. (38 cu. m) more than the first 25 cu. yd. (19 cu. m) of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Concrete unit masonry.
2. Brick unit masonry
3. Mortar and grout
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Miscellaneous masonry accessories.

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

1. Division 7 Section "Bituminous Dampproofing: for dampproofing applied to cavity face of backup wythes of cavity walls.
2. Division 7 Section "Joint Sealants" for sealing joint in mockup.
3. Division 7 Section “Sheet Metal Flashing and Trim” for exposed sheet metal flashing.
4. Division 10 Section “Louvers and Vents” for wall vents.

C. Products installed but not furnished under this Section include the following:

1. Steel lintels for unit masonry specified in Division 5 Section "Metal Fabrications."
2. Steel shelf angles for unit masonry specified in Division 5 Section "Metal Fabrications."
3. Wood nailers and blocking built into unit masonry specified in Division 6 Section "Rough Carpentry."
4. Hollow metal frames in unit masonry openings specified in Division 8 Section "Steel Doors and Frames."

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

1. For Concrete Unit Masonry: As follows, based on net area:

a. f'm = 1500 psi (13.1 Mpa) for thee units.

2. For Brick Unit Masonry: As follows, based on gross area:

a. f'm = 1500 psi (13.1 MPa).

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each different masonry unit, accessory, and other manufactured product specified.

C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

D. Samples for initial selection of the following:

1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.

E. Samples for verification of the following:

1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Weep holes/vents in color to match mortar color.

F. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:

1. Mortar complying with property requirements of ASTM C 270.
2. Mortar complying with BIA M1.
3. Grout mixes. Include description of type and proportions of grout ingredients.
4. Masonry units.

G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. The General Contractor shall employ and pay a qualified professional engineer to provide a survey and inspection of foundations for compliance with dimensional tolerances.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Preconstruction Testing: Employ and pay a qualified independent testing agency to perform the following preconstruction testing to establish compliance of proposed materials and construction with specified requirements:

1. Test grout compressive strength per ASTM C 1019.

D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

E. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.

F. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:

1. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:

a. 40 to 32 deg F (4 to 0 deg C): Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C).
b. 32 to 25 deg F (0 to -4 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry.
c. 25 to 20 deg F (-4 to -7 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C) if grouting. Use heat on both sides of walls under construction.
d. 20 deg F (-7 deg C) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C). Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F (0 deg C) within the enclosures.

2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:

a. 40 to 25 deg F (4 to -4 deg C): Cover masonry with a weather-resistant membrane for 48 hours after construction.
b. 25 to 20 deg F (-4 to -7 deg C): Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h (25 km/h).
c. 20 deg F (-7 deg C) and Below: Provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after construction.

3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Concrete Masonry Units:

a. Grand Blanc Cement Products, Inc.
b. National Block Company
c. Van Poppelen Bros.
d. Brighton Block Company
e. Ferguson Block

2. Brick:

   a. The Beldon Brick Sales Company
   b. Acme Brick Co.
   c. Cherokee Sanford Group, Inc.
   d. Cushwa: Victor Cushwa & Sons, Inc.
   e D'Hanis Brick and Tile Co.
   f. Endicott Clay Products Co.
   g. Glen-Gery Corporation
   h. Henderson Brick
   i. Merry Brothers Brick & Tile Co.
   jk. Pacific Coast Building Products: Interstate Brick Div.
   k. Robinson Brick Co.
   l. Summit Brick & Tile.
   m. McVoy Brick Company
   n. Srvan Brick & Stone

3. Portland Cement, Mortar Cement, Masonry Cement, and Lime:

   a. Essroc Materials, Inc.
   b. Glen-Gery Corporation.
   c. Lafarge Corporation.
   d. Lehigh Portland Cement Co.
   e. Riverton Corporation (The).
   f. W.R. Grace & Co.
   g. St. Mary's Mortar Cement

4. Mortar Pigments:

   a. Davis Colors.
   b. Lafarge Corporation.
   c. Solomon Grind-Chem Services, Inc.

5.. Joint Reinforcement, Ties, and Anchors:

   a. Dur-O-Wal, Inc.
   b. Heckman Building Products, Inc.
   c. Hohmann & Barnard, Inc.
   d. Masonry Reinforcing Corp. of America.
   e. National Wire Products Industries.
   f. Southern Construction Products.

2.2 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required.

   1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for outside corners and door openings, unless otherwise indicated.

B. Concrete Masonry Units: ASTM C 90 and as follows:

   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated below:

a. 1900 psi (13.1 MPa).
b. Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.

2. Weight Classification: Medium weight.
3. Aggregates: Do not use aggregates made from pumice, scoria, or tuff.
4. Provide Type I, moisture-controlled units.
5. Size: Manufactured to the actual dimensions indicated on Drawings within tolerances specified in the applicable referenced ASTM specification.
6. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on Drawings:

   a. 4 inch (100 mm) nominal: 3-5/8 inch (92 mm) actual.
   b. 6 inch (150 mm) nominal: 5-5/8 inch (143 mm) actual.
   c. 8 inch (200 mm) nominal: 7-5/8 inch (194 mm) actual.
   d. 10 inch (250 mm) nominal: 9-5/8 inch (244 mm) actual.
   e. 12 inch (300 mm) nominal: 11-5/8 inch (295 mm) actual.

7. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.3 BRICK

A. General: Provide shapes indicted and as follows for each form of brick required.

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.
2. Base unit brick size as indicated shall be custom to match existing brick (8” x 3-5/8” x 2-5/8”).

B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes and lintels.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: ASTM C 216 and as follows:

1. Grade and Unit Compressive Strength: Provide units with grade and minimum average net-area compressive strength indicated below.

   a. Grade: SW
   b. 3000 psi (20.7 Mpa).

2. Initial Rate of Absorption: Between 5 and 20 g/30sq. in. (g/194 sq. cm) per minute when tested per ASTM C 67.
3. Type: FBS.
4. Size: Bricks manufactured to the following actual dimensions within tolerances specified in ASTM C 216:

   a. Modular: 3-5/8 inches thick by 2-1/4 inches high by 7-5/8 inches long.

5. Color and Texture:

   a. Brick: Jumbo St. Anne Clear A 02-06 as supplies by the Beldon Brick Sales Co., 31470 Utica Road, Fraser, MI (586) 294-5400 – Mark Lariviere, Jr. or Architect approved equal to match existing.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Masonry Cement: Type S Mortar: 1800 PSI (124 mpA) after 28 days.

1. For pigmented mortars, use premixed, colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 5 percent of masonry cement by weight for mineral oxides nor 1 percent for carbon black.
2. For colored-aggregate mortars, use masonry cement of natural color or white as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

1. For pigmented mortars, use colored portland cement-lime mix of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.

E. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm), use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.

1. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone, as required to match Architect's sample.

F. Aggregate for Grout: ASTM C 404.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

H. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMU, containing integral water repellent by same manufacturer.

K. Water: Potable.

L. Products: Subject to compliance with requirements, provide one of the following:

1. Colored Masonry Cement:

    a. Brixment-in-Color; Essroc Materials, Inc.
    b. Centurion Colorbond; Lafarge Corporation.
    c. Lehigh Custom Color Masonry Cement; Lehigh Portland Cement Co.
    d. Flamingo Color Masonry Cement; Riverton Corporation (The).

2. Colored Portland Cement-Lime Mix:

    a. Color Mortar Blend; Glen-Gery Corporation.
    b. Centurion Colorbond PL; Lafarge Corporation.
    c. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
    d. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).

3. Mortar Pigments:

    a. True Tone Mortar Colors; Davis Colors.
    b. Centurion Pigments; Lafarge Corporation.
    c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

4. Cold-Weather Admixture:

    a. Accelguard 80; Euclid Chemical Co.
    b. Morset; Grace: W.R. Grace & Co.

5. Water-Repellent Admixture:

    a. “Dry-Bloc” mortar admixture, W.R. Grace & Co. shall be used in laying all exterior masonry units.
    b. “Dry-Brick” mortar admixture, W.R. Grace & Co., shall be used in laying all exterior brick masonry units.

2.5 REINFORCING STEEL

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615 (ASTM A 615M).

    a. Grade 60 (Grade 400).

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

2.6 JOINT REINFORCEMENT

A. General: Provide joint reinforcement formed from the following:

1. Galvanized carbon-steel wire, coating class as follows:

    a. ASTM A 641 (ASTM A 641M), Class 1, for interior walls; and ASTM A 153, Class B-2, for exterior walls.

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet (3 m), with prefabricated corner and tee units, and complying with

requirements indicated below:

1. Wire Diameter for Side Rods: 0.1483 inch (3.8 mm).
2. Wire Diameter for Cross Rods: 0.1483 inch (3.8 mm).

C. For single-wythe masonry, provide type as follows with single pair of side rods:

1. Ladder design with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c.

D. For multiwythe masonry, provide type as follows:

1. Ladder design with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c.

a. Number of Side Rods for Multiwythe Concrete Masonry: One side rod for each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod for each wythe of masonry 4 inches (100 mm) or less in width.
b. Provide integral drips on cross rods at cavity walls.

2.7 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.

B. Wire: As follows:

1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
2. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for wire ties and anchors in exterior walls.
3. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 641 (ASTM A 641M), Class 1 coating for wire ties and anchors in interior walls.
4. Wire Diameter: 0.1875 inch (4.8 mm).

C. Steel Plates and Bars: ASTM A 36 (ASTM A 36M), shop painted with 2 coats of coal-tar epoxy-polyamide paint complying with SSPC-Paint 16 to comply with SSPC-PA 1 for painting and SSPC-SP 6 for surface preparation.

2.8 ADJUSTABLE MASONRY-VENEER ANCHORS

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2.9 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.
2. Nonheaded bolts, straight.

3. Nonheaded bolts, bent in manner indicated.
4. Type: Chemical anchors.
5. Type: Expansion anchors.
6. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

2.10 EMBEDDED FLASHING MATERIALS

A. Reinforced Plastic Flashing: Manufacturer's standard composite plastic flashing as described below:

1. Polyester film bonded to fiberglass scrim reinforcement and 1.25-mil (0.03-mm) black-vinyl ethylene film, with a total thickness of 8 mils (0.2 mm).
2. Joint Tape: Reinforced plastic flashing manufacturer's standard polyester tape, 2 inches (50 mm) wide by 2.0 mils (0.05 mm) thick.
3. Application: Use where flashing is fully concealed in masonry.

B. Stainless Steel Drip Edge: Item SS-A as manufactured by Illinois Products Company stainless steel in 8' lengths .015 inches thick x 2 inches wide.

C. Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Reinforced Plastic Flashing:

a. Fiberweb 200; DUR-O-WALL, Inc.

2. Rubberized Asphalt Sheet Flashing:

a. Perm-A-Barrier Wall Flashing; Grace: W.R. Grace & Co.
b. Polyguard 300; Polyguard Products, Inc.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Type 2, Class A, Grade 1; compressible up to 35 percent; of width and thickness indicated; formulated from the following material:

1. Neoprene.
2. Urethane.
3. Polyvinyl chloride.

B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Polyvinyl Chloride: ASTM D 2287, General Purpose Grade, Type PVC-65406.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep Holes: Provide the following:

1. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch (9-mm) outside diameter by 4 inches (100 mm) long.

2.12 MASONRY CLEANERS

A. Job Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal (4-L) of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

1. For masonry not subject to metallic, oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
2. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
3. Products: Subject to compliance with requirements, provide one of the following:

a. 202 New Masonry Detergent; Diedrich Technologies, Inc.
b. 200 Lime Solv; Diedrich Technologies, Inc.
c. 202V Vana-Stop; Diedrich Technologies, Inc.
d. Sure Klean No. 600 Detergent; ProSoCo, Inc.
e. Sure Klean No. 101 Lime Solvent; ProSoCo, Inc.
f. Sure Klean Vana Trol; ProSoCo, Inc.

2.13 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
2. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
3. Products: Subject to compliance with requirements, provide one of the following:

a. 202 New Masonry Detergent; Diedrich Technologies, Inc.
b. 200 Lime Solv; Diedrich Technologies, Inc.
c. 202V Vana-Stop; Diedrich Technologies, Inc.
d. Sure Klean No. 600 Detergent; ProSoCo, Inc.
e. Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.
f. Sure Klean Vana Trol; ProSoCo, Inc.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather

conditions, in order to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:

1. Limit cementitious materials in mortar for exterior use to portland cement and lime.
2. For masonry below grade and, in contact with earth, use type indicated below:

a. Type: M.

3. For reinforced and load bearing masonry, use type indicated below:

a. Type: S.

4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions, and for other applications where another type is not indicated, use type indicated below:

a. Type: N.

C. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

1. Limit pigments to the following percentages of cement content by weight:

a. For mineral oxide pigments and portland cement-lime mortar, not more than 10 percent.
b. For mineral oxide pigments and masonry cement mortar, not more than 5 percent.
c. For carbon-black pigment and masonry cement mortar, not more than 1 percent.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates combined with selected cementitious materials.

1. Mix to match existing brick mortar.

E. Grout for Unit Masonry: Comply with ASTM C 476. Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.

1. Use fine grout in grout spaces less than 2 inches (50 mm) in horizontal dimension, unless otherwise indicated.
2. Use coarse grout in grout spaces 2 inches (50 mm) or more in least horizontal dimension, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections of the Specifications.

C. Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

F. Wetting of Brick: Wet brick prior to laying if the initial rate of absorption exceeds 30 g/30 sq. in. (g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb the water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (10 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For top surface of bearing walls, do not exceed 1/8 inch (3 mm) in 10 feet (3 m), nor 1/16 inch (1.5 mm) within width of a single unit.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet (12 mm in 6 m), nor 3/4 inch in 40 feet (19 mm in 12 m) or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch (6 mm) nor plus 1/2 inch (12 mm).

E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch (3 mm). Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch (3 mm). Do not vary from collar-joint thickness indicated by more than minus 1/4 inch (6 mm) or plus 3/8 inch (10 mm).

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.
2. Stack bond.
3. One-third running bond.
4. As indicated on Drawings.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-in Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

I. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

J. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:

1. Install safing insulation in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch (10-mm) joints.

B. Lay hollow brick and structural clay tile as follows:

1. Lay vertical-cell units with full head joints, unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
2. Lay horizontal-cell units with full bed joints, unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit in place and one side of unit to be placed.
3. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch (6- to 10-mm) joints.
4. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar to comply with epoxy-mortar manufacturer's directions.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.6 STRUCTURAL BONDING OF MULTIWYTHE MASONRY

A. Use continuous horizontal-joint reinforcement installed in horizontal mortar joints for bond tie between wythes.

B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. Provide continuity with horizontal-joint reinforcement at corners by using prefabricated "L" units in addition to masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

1. Provide continuity with horizontal-joint reinforcement by using prefabricated "T" units.
2. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.7 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

B. Tie exterior wythe to back-up with individual metal ties. Stagger alternate courses.

C. Tie exterior wythe to back-up with continuous horizontal-joint reinforcing at composite brick/concrete block composite wall.

3.8 HORIZONTAL-JOINT REINFORCEMENT

A. General: Provide continuous horizontal-joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcing a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.

2. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 12 inches (305 mm) beyond opening.

    a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.

C. Form expansion joints in brick made from clay or shale as follows:

1. Build-in joint fillers where indicated.
2. Form open joint of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants." Maintain joint free and clear of mortar.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with mortar.

C. Install flashing as follows:

1. At composite masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches (100 mm), and through the inner wythe to within 1/2 inch (13 mm) of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches (50 mm), unless otherwise indicated.
2. At masonry-veneer walls, extend flashing from exterior face of veneer, through the veneer, up face of sheathing at least 8 inches (200 mm), and behind air-infiltration barrier/building paper.

3. At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn up not less than 2 inches (50 mm) to form a pan.
4. Cut off flashing flush with face of wall after masonry wall construction is completed. Install continuous stainless steel drip edge at all locations.

D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:

1. Form weep holes with product specified in Part 2 of this Section.
2. Space weep holes 32" o.c.
3. In cavities, place pea gravel to a height equal to height of first course, but not less than 2 inches (50 mm), immediately above top of flashing embedded in the wall, as masonry construction progresses, to splatter mortar droppings and to maintain drainage.

E. Install nailers for flashing and other related construction where shown to be built into masonry.

3.12 INSTALLATION OF REINFORCED UNIT MASONRY

A. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Do not exceed the following pour heights for fine grout:

a. For minimum widths of grout spaces of 3/4 inch (19 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches (38 by 51 mm), pour height of 12 inches (305 mm).
b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2 by 3 inches (51 by 76 mm), pour height of 60 inches (1524 mm).
c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 12 feet (3.6 m).
d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 24 feet (7.3 m).

2. Do not exceed the following pour heights for coarse grout:

a. For minimum widths of grout spaces of 1-1/2 inches (38 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches (38 by 76 mm), pour height of 12 inches (305 mm).
b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 60 inches (1524 mm).
c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 12 feet (3.6 m).
d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 4 inches (76 by 101 mm), pour height of 24 feet (7.3 m).

3. Provide cleanout holes at least 3 inches (76 mm) in least dimension for grout pours over 60 inches (1524 mm) in height.

a. Provide cleanout holes at each vertical reinforcing bar.
b. At solid grouted masonry, provide cleanout holes at not more than 32 inches (813 mm) o.c.

3.13 FIELD QUALITY CONTROL

A. The General Contractor will employ and pay a qualified independent testing agency to perform the following testing for field quality control. Retesting of materials failing to meet specified requirements

shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof.

C. Mortar properties will be tested per property specification of ASTM C 270.

D. Grout will be sampled and tested for compressive strength per ASTM C 1019.

E. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM E 447, Method B, and as follows:

1. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days.

F. Evaluation of Quality-Control Tests: In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality-control tests comply with minimum requirements indicated.

G. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C 67.

H. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean brick by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised, using the following masonry cleaner:

    a. Job-mixed detergent solution.

6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.

E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.15 MASONRY WASTE DISPOSAL

A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in greatest dimension.
2. Mix masonry waste with at least 2 parts specified fill material for each part masonry waste. Fill material is specified in Division 2 Section "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes structural steel and architecturally exposed structural steel.

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

1. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous steel framing.
3. Division 9 Section "Painting" for surface preparation and priming requirements.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.

3. Direct-tension indicators.
4. Shop primers.
5. Nonshrink grout.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:

a. Category: Category II, complex steel building structures.
b. Fabricator shall be registered with and approved by authorities having jurisdiction.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
3. AISC's "Seismic Provisions for Structural Steel Buildings."
4. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
5. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Plates, and Bars: As follows:

1. Carbon Steel: ASTM A 36 (ASTM A 36M).

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

C. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36 (ASTM A 36M).
2. Unheaded Bolts: ASTM A 687, high strength.
3. Headed Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
4. Headed Bolts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
5. Headed Bolts: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
6. Washers: ASTM A 36 (ASTM A 36M).

D. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.
2. Direct-Tension Indicators: ASTM F 959, Type 490, uncoated.

E. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

2.3 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and

water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

E. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

F. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

A. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.

2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.7 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 "Hand Tool Cleaning."
2. SSPC-SP 3 "Power Tool Cleaning."
3. SSPC-SP 11 "Power Tool Cleaning to Bare Metal."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 SOURCE QUALITY CONTROL

A. The General Contractor will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

D. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Splice members only where indicated.

F. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.5 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).

END OF SECTION 051200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following metal fabrications:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Shelf and relieving angles.
4. Miscellaneous framing and supports for the following:

    a. Applications where framing and supports are not specified in other sections.

5. Miscellaneous steel trim, including the following:

    a. Edgings.

6. Pipe bollards.

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

1. Division 5 Section "Structural Steel" for structural steel framing system components.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for nonslip aggregates and nonslip aggregate surface finishes, prefabricated building columns, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.

C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

D. Samples representative of materials and finished products as may be requested by Architect.

E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," and AWS D1.3 "Structural Welding Code--Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).

C. Rolled Steel Floor Plates: ASTM A 786 (ASTM A 786M).

D. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500.
2. Hot-Formed Steel Tubing: ASTM A 501.

a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

E. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.

1. Black finish, unless otherwise indicated.

F. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27 (ASTM A 27M) cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

G. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 FASTENERS

A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.

C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).

D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).

E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

F. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).

G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

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 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 agency.

1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).

I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

2.4 GROUT

A. Nonshrink, Metallic Grout: (Interior Application) Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

B. Nonshrink, Nonmetallic Grout: (Exterior Application) Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Nonshrink, Metallic Grouts:

a. Supreme Plus; Cormix Construction Chemicals.
b. Hi Mod Grout; Euclid Chemical Co.
c. Embeco 885 and 636; Master Builders Technologies, Inc.
d. Ferrolith G Redi-Mix and G-NC; Sonneborn Building Products--ChemRex, Inc.
e. Met-ox; The Spray-Cure Company.

2. Nonshrink, Nonmetallic Grouts:

a. B-6 Construction Grout; W. R. Bonsal Co.
b. Diamond-Crete Grout; Concrete Service Materials Co.
c. Supreme; Cormix Construction Chemicals.
d. Sure-grip High Performance Grout; Dayton Superior Corp.
e. Euco N-S Grout; Euclid Chemical Co.
f. Five Star Grout; Five Star Products.
g. Vibropruf #11; Lambert Corp.
h. Crystex; L & M Construction Chemicals, Inc.
i. Masterflow 928 and 713; Master Builders Technologies, Inc.
j. Sealtight 588 Grout; W. R. Meadows, Inc.
k. Sonogrout 14; Sonneborn Building Products--ChemRex, Inc.
l. Kemset; The Spray-Cure Company.

2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Shear and punch metals cleanly and accurately. Remove burrs.

D. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Remove sharp or rough areas on exposed traffic surfaces.

F. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

I. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

J. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

K. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.7 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of 1 inch per foot (85 mm per m) of clear span but not less than 8 inches (200 mm) bearing at each side of openings, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.9 SHELF AND RELIEVING ANGLES

A. Fabricate shelf and relieving angles from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and not more than 24 inches (600 mm) o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity wall exterior wythe.

C. Galvanize shelf angles to be installed on exterior concrete framing.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

a. Except as otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

C. Fabricate support for suspended toilet partitions, folding partitions and overhead doors as follows:

1. Beams: Continuous steel shapes of size required to limit deflection to L/360 between hangers, but use not less than C8 by 11.5 (C200 by 17.1) channels or another shape with equivalent structural properties.
2. Hangers: Steel rods, 1/2-inch (13-mm) minimum diameter, spaced not more than 36 inches (900 mm) o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge-shaped washers for full bearing on sloping flanges of support beam.
3. Braces and Angles: Steel angles of size required for rigid support of beam and for secure anchorage.

D. Galvanize miscellaneous framing and supports in the following locations:

1. Exterior locations.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior locations.

2.12 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.

B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

B. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

1. Use nonshrink, metallic grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING SUPPORTS FOR TOILET PARTITIONS

A. Anchor supports securely to and rigidly brace from overhead building structure.

3.5 INSTALLING PIPE BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.

B. Fill bollards solidly with concrete, mounding top surface.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a 2.0-mil (0.05-mm) minimum dry film thickness.

B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Steel pipe and tube handrails and railing systems.

1.3 DEFINITIONS

A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:

1. Aluminum: AA "Specifications for Aluminum Structures."
2. Cold-Formed Structural Steel: AISI "Specification for the Design of Cold-Formed Steel Structural Members."

B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.

1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
b. Uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
b. Uniform load of 50 lbf per linear foot (730 N/m) applied in any direction.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.

a. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.

C. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C) ambient 180 deg F (100 deg C) material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for mechanically connected handrails and railing systems, each kind of fitting, grout, anchoring cement, and paint products.

C. Shop drawings showing fabrication and installation of handrails and railing systems including plans, elevations, sections, details of components, and attachments to other units of Work.

1. For installed handrails and railing systems indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.

a. Samples for initial selection in the form of short sections of railing or flat sheet metal samples showing available mechanical finishes.

D. Samples for verification of each type of exposed finish required, prepared on components indicated below that are of the same thickness and metal indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, names of architects and owners, and other information specified.

E. Product test reports from a qualified independent testing agency evidencing compliance of handrails and railing systems with requirements based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.

B. Engineer Qualifications: Professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated for handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.

1.7 STORAGE

A. Store handrails and railing systems inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where handrails and railing systems are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 SEQUENCING AND SCHEDULING

A. Sequence and coordinate installation of wall handrails as follows:

1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
2. Mount handrails on plaster or gypsum board assemblies only where reinforced to receive anchors and where the location of concealed reinforcements has been clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide handrails and railing systems by one of the following:

1. Steel Pipe and Tube Railings:

a. Humane Equipment Co.
b. Wagner: R & B Wagner, Inc.
c. Metro Fabricators, Inc.
d. Rohmann Iron Works, Inc.
e. Bristol Steel & Conveyor Corp.

2.2 METALS

A. General: Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:

1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

a. Black finish, unless otherwise indicated.
b. Galvanized finish for exterior installations and where indicated.

c. Type F, or Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.

2. Steel Tubing: Product type (manufacturing method) and other requirements as follows:

a. Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:

i. Grade A, unless otherwise indicated or required by structural loads.

b. Hot-Formed Steel Tubing: ASTM A 501.
c. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

3. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).

B. Brackets, Flanges, and Anchors: Cast or formed metal of the same material and finish as supported rails, unless otherwise indicated.

2.3 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railings to other types of construction indicated and capable of withstanding design loadings.

1. For steel railings and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting railing components and their attachment to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

C. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials, capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry 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 agency.

1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.
4. Undercut anchors.

2.4 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems

indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, complying with performance requirements of FS TT-P-664.

B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and compatibility with finish paint systems indicated, complying with SSPC-Paint 5.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Interior Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

C. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

D. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Nonshrink, Nonmetallic Grouts:

    a. B-6 Construction Grout; W.R. Bonsal Co.
    b. Diamond-Crete Grout; Concrete Service Materials Co.
    c. Supreme; Cormix Construction Chemicals.
    d. Sure-grip High Performance Grout; Dayton Superior Corp.
    e. Euco N-S Grout; Euclid Chemical Co.
    f. Five Star Grout; Five Star Products.
    g. Vibropruf #11; Lambert Corp.
    h. Crystex; L & M Construction Chemicals, Inc.
    i. Masterflow 928 and 713; Master Builders Technologies, Inc.
    j. Sealtight 588 Grout; W.R. Meadows, Inc.
    k. Sonogrout 14; Sonneborn Building Products--ChemRex, Inc.
    l. Kemset; The Spray-Cure Company.

2. Interior Anchoring Cement:

    a. Ankertite Cement; Dayton Superior Corp.
    b. Por-Rok; Minwax Construction Products Division.

3. Erosion-Resistant Anchoring Cement:

    a. Bonsal Anchor Cement; W.R. Bonsal Co.

b. Super Por-Rok; Minwax Construction Products Division.
c. Thorogrip; Thoro Systems Products.

2.6 FABRICATION

A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.

B. Assemble handrails and railing systems in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Form changes in direction of members as follows:

1. As detailed.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Welded Connections: Fabricate handrails and railing systems for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe or tube to which end is joined, and weld all around.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. Nonwelded Connections: Fabricate handrails and railing systems by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer's standard splicing method.

G. Welded Connections for Aluminum Pipe: Fabricate pipe handrails and railing systems by connecting members with concealed internal welds, which eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

H. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing system members to other construction.

I. Provide inserts and other anchorage devices to connect handrails and railing systems to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

J. For railing posts set in concrete, provide preset sleeves of steel, not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (12 mm) greater than outside dimensions of post, and steel plate forming bottom closure.

K. For removable railing posts, fabricate slip-fit sockets from steel pipe whose inside diameter is sized for a close fit with posts and to limit deflection of post without lateral load, measured at top, to not more than 1/12 of post height. Provide socket covers designed and fabricated to resist accidental dislodgement.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

L. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

M. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.

N. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

O. Provide weepholes, or another means to evacuate entrapped water, in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.

P. Fabricate joints that will be exposed to weather in a manner to exclude water.

Q. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

R. Fillers: Provide steel sheet or plate fillers, of thickness and size indicated or required to support structural loads of handrails, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses to produce adequate bearing to prevent bracket rotation and overstressing substrate.

2.7 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and they are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railing systems.

2.8 STEEL FINISHES

A. Galvanized Finish: Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing iron and steel products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.

B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. For nongalvanized steel handrails and railing systems, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except provide galvanized anchors where embedded in exterior masonry and concrete construction.

E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

F. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed railings:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7 "Brush-Off Blast Cleaning."

G. Apply shop primer to prepared surfaces of handrails and railing components, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

H. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections accurately together to form tight, hairline joints.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railing systems. Set handrails and railing systems accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/4 inch in 12 feet (2 mm in 1 m).
3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (2 mm in 1 m).

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.

D. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

E. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

F. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railing systems and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Locate exposed fasteners in least conspicuous locations. Seal recessed holes of exposed locking screws with plastic filler, cement colored to match finish of handrails and railing systems.

B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.

3.4 ANCHORING POSTS

A. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.

1. Nonshrink, nonmetallic grout.

B. Cover anchorage joint with a round steel flange attached to post as follows:

1. By set screws.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts as indicated using fittings designed and engineered for this purpose.
2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

D. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

3.5 ANCHORING RAIL ENDS

A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post-installed anchors and bolts.

B. Anchor rail ends to metal surfaces with oval or round flanges.

1. Weld flanges to rail ends.
2. Connect flanges to rail ends using non-welded connections.
3. Bolt flanges to metal surfaces.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
3. For hollow masonry anchorage, use toggle bolts with square heads.
4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.7 ADJUSTING AND CLEANING

A. Clean the following metals by washing thoroughly with clean water and soap, followed by rinsing with clean water.

1. Aluminum.
2. Stainless steel.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

3.8 PROTECTION

A. Protect finishes of handrails and railing systems from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Wood furring, grounds, nailers, and blocking.
3. Exterior wall sheathing.
4. Roof sheathing.
5. Building wrap.
6. Vented aluminum soffits

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

1. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

B. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.

C. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

D. Warranty of chemical treatment manufacturer for each type of treatment.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by a single producer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

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:

1. Wood-Preservative-Treated Materials:

a. Baxter: J. H. Baxter Co.
b. Chemical Specialties, Inc.
c. Continental Wood Preservers, Inc.
d. Hickson Corp.
e. Hoover Treated Wood Products, Inc.
f. Osmose Wood Preserving, Inc.

2. Gypsum Sheathing Board:

a. Domtar Gypsum.
b. Georgia-Pacific Corp.
c. National Gypsum Co.; Gold Bond Building Products Division.
d. United States Gypsum Co.

3. Air-Infiltration Barriers:

a. Amoco Foam Products Co.
b. Anthony Industries, Inc.; Simplex Products Division.
c. Celotex Corporation (The); Building Products Division.
d. DuPont Company; Fibers Department.
e. Parsec, Inc.
f. Raven Industries, Inc.
g. Reemay, Inc.
h. Sto-Cote Products, Inc.

4. Metal Framing Anchors:

a. Cleveland Steel Specialty Co.
b. Harlen Metal Products, Inc.
c. Silver Metal Products, Inc.
d. Simpson Strong-Tie Company, Inc.
e. Southeastern Metals Manufacturing Co., Inc.

5. Vented Aluminum Soffits:

a. Gentek Building Products, Inc.
b. Kaycan Ltd.
c. Mastic Home Exteriors; PLY GEM Siding Group
d. Norandex Building Materials Distribution, Inc.
e. Rollex Corporation

2.2 LUMBER, GENERAL

A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority (Canadian).
3. RIS - Redwood Inspection Service.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB - West Coast Lumber Inspection Bureau.
6. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.

D. 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.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

E. Wood Structural Panels:

1. Plywood: DOC PS 1, unless otherwise indicated.
2. Thickness: As needed to comply with requirements specified but not less than thickness indicated on the Contract Documents.
3. Comply with “Code Plus” provisions in APA Form No. E30K, “APA Design/Construction Guide: Residential & Commercial.”
4. Factory mark panels according to indicated standard.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

1. Do not use chemicals containing chromium or arsenic.
2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items 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 members less than 18 inches (460 mm) above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Non-Load-Bearing Interior Partitions: Construction, Stud or No. 2 grade and any of the following species:

1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Spruce-pine-fur (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.

C. Exterior and Load-Bearing Walls: Construction or No. grade and any of the following species:

1. Douglas fir-larch; WCLIB or WWPA.
2. Douglas fir-south; WWPA.
3. Douglas fir-larch (north); NLGA
4. Hem-fir; WCLIB or WWPA.
5. Hem-fir (north); NLGA.

2.5 SHEATHING

A. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.

1. Span Rating: Not less than 16/0.
2. Thickness: Not less than ½ inch.

B. Plywood Roof Sheathing: Exposure 1 sheathing.

1. Span Rating: Not less than 24/0.
2. Thickness: Not less than ½ inch.

2.6 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

E. Engineered lumber shall consist of microllam LVL beams and parallam columns as manufactured by Trust Joists (Weyerhauser) sizes as indicated on drawings.

2.7 AIR-INFILTRATION BARRIER

A. Air retarder complying with ASTM E 1677; made from polyolefins; either cross-laminated films, woven strands, or spunbonded fibers; coated or uncoated; with or without perforations to transmit water vapor but not liquid water; and as follows:

1. Minimum Thickness: 3 mils (0.08 mm).
2. Minimum Water-Vapor Transmission: 10 perms (575 ng/Pa x s x sq. m) when tested according to ASTM E 96, Procedure A.
3. Maximum Flame Spread: 25 per ASTM E 84.
4. Minimum Allowable Exposure Time: 3 months.
5. Basis of Design: Tyvek Drain Wrap.

2.8 VENTED ALUMINUM SOFFITS

A. Vented Aluminum Soffits shall consist of 12” wide triple v groove fully vented soffit panels with manufacturer’s standard three coat PVDF finish system. Panels shall be 0.024 inch thick. Provide manufacturer’s trim and accessories for a complete installation and install and support system in accordance with manufacturer’s recommendation.

2.9 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

F. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.10 METAL FRAMING ANCHORS

A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated on the contract drawings.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

2.11 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.3 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

1. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

B. Furring to Receive Gypsum Board: Install 2-by-2-inch nominal-size furring at 16 inches (406 mm) o.c., vertically.

3.4 AIR-INFILTRATION BARRIER

A. Cover sheathing with air-infiltration barrier as follows:

B. Apply air retarder to comply with manufacturer's written instructions.

3.5 SHEATHING TAPE APPLICATION

A. Apply sheathing tape to joints between sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION 061000

SECTION 061753 – SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes wood roof trusses and truss accessories.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for roof sheathing and subflooring and dimension lumber for supplementary framing and permanent bracing.
2. Division 6 Section "Miscellaneous Carpentry" for roof sheathing and subflooring and dimension lumber for supplementary framing and permanent bracing.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
2. Maximum Deflection Under Design Loads:

a) Roof Trusses: Vertical deflection of 1/360 of span.

1.5 SUBMITTALS

A. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the State of Michigan responsible for their preparation.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Metal-plate connectors.
2. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPI 1.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.

D. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with TPI recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Connector Plates:

    1) Alpine Engineered Products, Inc.
    2) CompuTrus, Inc.
    3) Eagle Metal Products.
    4) Jager Industries, Inc.
    5) Mitek Industries, Inc.
    6) Robbins Engineering, Inc.
    7) TEE-LOK Corporation.
    8) Truswal Systems Corporation.

2. Metal Framing Anchors:

    1) Alpine Engineered Products, Inc.
    2) Cleveland Steel Specialty Co.
    3) Harlen Metal Products, Inc.
    4) KC Metals Products, Inc.
    5) Silver Metal Products, Inc.
    6) Simpson Strong-Tie Company, Inc.
    7) Southeastern Metals Manufacturing Co., Inc.
    8) United Steel Products Company, Inc.

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
3. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.3 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:

B. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180) coating designation; Designation SS, Grade 33, and not less than 0.036 inch (.9 mm thick).

C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, 80Z (24G) coating designation; ASTM A 570/A 570M, Structural Steel (SS), Grade 33, and not less than 0.047 inch (1.2 mm) thick.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. 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: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 METAL FRAMING ANCHORS

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:

1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meets or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

C. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches (63 mm wide by 0.062 inch (1.6 mm) thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.

2.6 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. Before installing, splice trusses delivered to Project site in more than one piece.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses 24 inches (610 mm) o.c. adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.

H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

I. Install wood trusses within installation tolerances in TPI 1.

J. Do not cut or remove truss members.

K. Replace wood trusses that are damaged or do not meet requirements.

1. Do not alter trusses in field.

END OF SECTION 061753

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Plastic laminate countertops.
2. Solid surface countertops and window sills.
3. Flush wood paneling and wainscot.
4. Interior ornamental work.

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

1. Division 6 Section "Rough Carpentry" for exposed framing and for furring, blocking, shims, and hanging strips for installing interior woodwork.
2. Division 6 Section "Rough Carpentry" for exposed framing and for furring, blocking, and other carpentry work concealed in the wall.
3. Division 8 Section "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.
4. Division 9 Section "Painting" for field finishing of installed interior architectural woodwork.
5. Division 12 Section “Kitchen Casework” for kitchen cabinetry.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details to an acceptable scale which clearly shows products and components.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.

3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.

D. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.
3. Plastic laminates.

E. Samples for verification of the following:

1. Laminate-clad panel products, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
2. Exposed cabinet hardware, one unit for each type and finish.

F. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.

G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

C. Quality Standard: Except as otherwise indicated, comply with the following standard:

1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.

D. Mockup: Prior to fabricating or installing interior architectural woodwork, construct mockup to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockup of the size indicated, using materials indicated for final unit of work, and complying with the following requirements.

1. Locate mockup on site in the location indicated or, if not indicated, as directed by Architect.
2. Notify Architect one week in advance of the date and time when fabrication of mockup will begin.
3. Notify Architect one week in advance of the date and time when mockup will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's acceptance of mockup before start of final unit of Work.
6. Retain and maintain mockup during construction in an undisturbed condition as a standard for judging the completed Work.

a. Accepted mockup in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed 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.

B. Hardware Coordination: Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section "Door Hardware" to fabricator of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:

B. General: Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade indicated, unless otherwise indicated.

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Softwood Plywood: PS 1.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

C. Formaldehyde Emission Level for Medium-Density Fiberboard: Comply with requirements of NPA 9.

D. Particleboard: ANSI A208.1, Grade M-2 made with phenol-formaldehyde resins.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated in the Work include, but are not limited to, the following:

a. Formica Corporation.
b. Laminart.
c. Nevamar Corp.
d. Pioneer Plastics Corp.
e. Westinghouse Electric Corp.; Specialty Products Div.
f. Ralph Wilson Plastics Co.

F. Adhesive for Bonding Plastic Laminate: Contact cement.

G. Wood Species and Cut for Transparent Finish: Red oak, plain sawn or sliced.

H. Wood Species for Opaque Finish: Any closed-grain hardwood.

2.2 CABINET HARDWARE AND ACCESSORY MATERIALS

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware."

B. Cabinet Hardware Schedule: Refer to schedule at end of this Section for cabinet hardware required for architectural cabinets.

C. Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA code number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
2. Satin Stainless Steel, Stainless-Steel Base: BHMA 630.

E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.

2.3 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Rough Carriages for Stairs: Comply with requirements of Division 6 Section "Rough Carpentry" for structural framing lumber. Kiln dry to less than 15 percent moisture content.

C. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.

D. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

E. 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 bolt devices for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:

1. Grade: Premium.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid-wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
2. Edges of rails and similar members more than 3/4 inch (19 mm) thick: 1/8 inch (3 mm).

D. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

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. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

F. Install glass to comply with applicable requirements of Division 8 Section "Glazing" and of FGMA "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Quality Standard: comply with AWI Section 300.

B. Grade: Premium

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

E. Assemble casings in plant except where limitations of access to place of installation require field assembly.

F. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed t pull connections together.

G. Wood Species and Cut: Red oak, rift sawn.

1. Provide split species on trim that face areas with difference wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

2.6 PLASTIC LAMINATE COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 requirements for countertops.

1. Grade: Premium.

B. Type of Top: High-pressure decorative laminate complying with the following:

1. Grade: GP-50, 0.050-inch (1.270-mm) nominal thickness.
2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

a. Provide Architect's selections from manufacturer's full range of colors and finishes in the following categories:

1) Solid colors.
2) Solid colors, with core same color as surface.
3) Wood grains.
4) Patterns.

3. Grain Direction: Parallel to cabinet fronts.
4. Edge Treatment: Same as laminate cladding on horizontal surfaces.
5. Core Material: Medium-density particleboard.

2.8 SOLID SURFACING MATERIALS

A. Description:

1. Base Product: DuPont de Nemours (Corian). Provide for public countertops and where indicated on drawings.
2. Cast, non-porous, homogeneous, acrylic polymer composition with additional fire retardant fillers and pigments.

a. Prime product may not be coated, laminated of composite construction.
b. Through body colors shall comply with ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.

3. Defects with depth <0.010 inches shall be considered “superficial”.

a. Superficial damage shall be repaired by sanding and/or polishing.

b. Components with more severe defects shall be rejected.

B. Acceptable manufacturers:

1. Solid Surfacing (SSF) fabrications:

a. Base:

1) DuPont de Nemours (Corian).

b. Optional:

1) Aristech Acrylics LLC, (Avonite)
2) Wilsonart International
3) Formica Surell
4) Staron
5) LG Decorative Surfaces

2.9 FLUSH WOOD PANELING AND WAINSCOTS

A. Quality Standard: Comply with AWI Section 500 requirements for flush wood paneling.

B. Quality Standard: Comply with WIC Section 11.

C. Grade: Premium.

D. Wood Species and Cut: Red oak, plain sawn or sliced.

1. Lumber Trim and Edges: At fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels.

E. Matching of Adjacent Veneer Leaves: Book.

F. Vertical Matching of Adjacent Veneer Leaves: End match.

G. Veneer Matching with Panel Face: Running.

H. Panel-Matching Method: Match panels within each separate area by the following method:

1. Sequence-matched, uniform-size sets.
2. Refer to Division 1 Section "Summary of Work" for requirements concerning flitches reserved by Architect.
3. Refer to Division 1 Section "Allowances" for allowances covering the purchase of wood face veneers for panels and components.

I. Vertical Panel-Matching Method: End match.

2.10 INTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 700.

B. Grade: Premium.

C. Wood Species and Cut: Red oak, rift sawn or cut.

2.11 STAIRWORK AND RAILS

A. Quality Standard: Comply with AWI Section 800.

B. Quality Standard: Comply with WIC Section 13.

C. Grade: Premium.

D. Wood Species and Cut: Red oak, rift sawn.

E. Wood Species for Opaque Finish: Any closed-grain hardwood.

F. Finishes for Stair Parts: As follows:

1. Treads: Transparent.
2. Risers: Transparent.
3. Stringers: Transparent.
4. Handrails: Transparent.

2.12 SHOP FINISHING

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.

1. Grade: Provide finishes of same grades as items to be finished.

B. General: The entire finish of interior architectural woodwork is specified in this Section, regardless of whether shop applied or applied after installation. The extent to which the final finish is applied at fabrication shop is Contractor's option, except shop apply at least the prime coat before delivery.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming; Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:

1. Grade: Premium.
2. AWI Finish System TR-0: Synthetic penetrating oil.
3. AWI Finish System TR-1: Standard lacquer.
4. AWI Finish System TR-2: Catalyzed lacquer.
5. AWI Finish System TR-3: Water-reducible acrylic lacquer.
6. AWI Finish System TR-4: Conversion varnish.
7. AWI Finish System TR-5: Catalyzed vinyl lacquer.
8. Staining: Match Architects sample.
9. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
10. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

11. Sheen: Semigloss, 55-75 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm)

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch and 96 inches (3mm in 2400 mm).

E. Cabinets: Install without distortion so that 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 the installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

F. Tops: Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400mm) sag, bow, or other variation from a straight line.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c.

G. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.

H. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless otherwise indicated.

1. Install flush paneling with no more than 1/16 inch in 96 inch (1.5 mm in 2400 mm) vertical cup or bow and 1/8 inch in 96 inch (3 mm in 2400 mm) horizontal variation from a true plane.

I. Stairwork and Rails: Cut carriages to accurately fit treads and risers and securely anchor to supporting substrates. Glue treads to risers, and glue and anil treads and risers to carriages. Glue and wedge treads and riser to housed stringer.

1. Install stairwork with treads and risers no more than 1/8 inch (3 mm) from indicated position and no more than 1/16 inch (1.5 mm) out of position for adjacent treads and risers. Install rails with no more than 1/8 inch in 96 inch (3 mm in 2400 mm) variation from a straight line.

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.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

3.5 CABINET HARDWARE AND ACCESSORY SCHEDULE

A. BHMA numbers are used below to designate hardware requirements, except as otherwise indicated.

B. Concealed (European Type) Hinges: B01602.

C. Pulls: B02011.

D. Pulls: Wire pulls, 4 inches (100 mm) long, 5/16 inches (8 mm) in diameter.

E. Catches: As follows:

1. Push-in Magnetic Catches: B03131.

F. Shelf Rests: B04013 (pre-drilled mounting holes in cabinets).

G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA A156.9, Grade 1 and rated for the following loads:

1. Box Drawer Slides: 75 lbf (330 N).
2. File Drawer Slides: 150 lbf (670 N).
3. Pencil Drawer Slides: 45 lbf (200 N).

H. Grommets for cable passage through countertops: 1.5 inch (25 mm) OD, molded-plastic grommets with 1-1/4-inch (19-mm) hole and plastic cap with slot for wire passage. Color as selected by Architect.

I. Silencers: Drawer and door application, clear-rubber with self-adhering adhesive.

END OF SECTION 064023

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Insulation under slabs-on-grade.
2. Foundation wall insulation (supporting backfill).
3. Cavity wall thermal and sound insulation.
4. Concealed building insulation.
5. Insulation above gypsum board ceiling systems.
6. Safing insulation.
7. Concrete block core insulation.

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

1. Division 2 Section "Foundation Drainage Systems" for insulated drainage panels.
2. Division 4 Section "Unit Masonry" for insulation installed in cavity walls and masonry cells.
3. Division 7 Section "Firestopping" for safing insulation.
4. Division 13 section “Pre-Engineered Steel Structures” for insulation supplied by steel building suppler.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of insulation product specified.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

1. Extruded-Polystyrene Board Insulation:

a. Amoco Foam Products Company.
b. DiversiFoam Products.
c. Dow Chemical Co.
d. UC Industries, Inc.; Owens-Corning Co.

2. Glass-Fiber Insulation:

a. CertainTeed Corporation.
b. Knauf Fiber Glass GmbH.
c. Owens-Corning Fiberglas Corporation.
d. Schuller International, Inc.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: (Below slab and foundation insulation) Rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process using hydrochlorofluorocarbons as blowing agent to comply with ASTM C 578 (Type VII) for type and with other requirements indicated below:

1. Type VII, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density, 60 psi minimum compressive strength, unless otherwise indicated.
2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 75 and 450, respectively.
3. Recycled Content: Not less than 50 percent blend of postconsumer and recovered polystyrene resins.

C. Glass-Fiber Sound Insulation: Unfaced mineral-fiber blanket insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I (blankets without membrane facing sound insulators). Provide sound attenuation batts within interior sound wall cavities where indicated on contract drawings. Basis of Design: Sound Attenuation Batts by Owens-Corning.

1. Mineral-Fiber Type: Fibers manufactured from glass.
2. Size: Thickness 3-1/2”; width 24”; length 96”
3. Surface-Burning Characteristics:

a. Maximum flame-spread: 10
b. Maximum smoke developed: 10, when tested in accordance with ASTM E 84.

4. Combustion Characteristics: Passes ASTM E 136.
5. Fire Resistance Ratings: Passes ASTM E 119 as part of a complete fire-tested wall assembly.
6. Sound Transmission Class: Possible improvement of STC rating 10 dbs.

7. Dimensional Stability: Linear shrinkage less than 0.1%.

D. Insulation Above Acoustic Panel Ceilings: Unfaced mineral-fiber blanket insulation complying with ASTM C 665, Type I and ASTM E 136. Provide insulation above acoustic panel ceilings where indicated on contract drawings. Basis of Design: Sonobatts Insulation Fiber Glass by Owens-Corning.

1. Mineral-Fiber Type: Fibers manufactured from glass.
2. Size: Thickness 5-1/2"' width 24"; length 48".
3. Caution. This facing will burn, facing must be installed in substantial contact with an approved ceiling.
4. R-Value: 19

E. Sprayed applied premium cellulose (basis of design "Nu-Wool") made from recycled paper, fire retardant, and resistant to mold growth. Compliant with CPSC standard 16 CFR Part 1209 and 1404. ASTM C-739 compliant with a Density of 1.6 lf/ft3. Thermal resistant per ASTM C-518 with 3.8 R value per inch of material. Compliant with ASTM E 970 & ASTM E 84 less than 25, Class I. Compliant with ASTM C739 for Moisture Vapor Absorption of less than 15% of maximum weight.

1. Field apply insulation in wall cavities and attics as detailed on the drawings with no voids and achieving the indicated minimum R Values based upon an R value of 3.8 per inch.
2. Install in accordance with manufacturer's recommendations.
3. Provide 4 mil polyethylene vapor barrier on warm side of insulation in accordance with the Michigan Building Code.

2.3 SAFING INSULATION AND ACCESSORIES

A. Slag-Wool-Fiber Board Safing Insulation: Semirigid boards designed for use as fire stop at openings between edge of slab and exterior wall panels, produced by combining slag-wool fibers with thermosetting resin binders to comply with ASTM C 612, Type IA and IB; nominal density of 4 lb/cu. ft. (64 kg/cu. m); passing ASTM E 136 for combustion characteristics; thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).

B. Calking Compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.

C. Safing Clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

2.4 INSULATION FASTENERS

A. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Anchor Adhesives:

a. TACTOO Adhesive; AGM Industries, Inc.
b. Tuff Bond Hanger Adhesive; Gemco.

2. Anchoring systems as recommended by insulation manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF RIGID BOARD PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

D. Install cellulous insulation in cavities formed by stud framing members according to the following requirements:

1. Fill all cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Provide even installation of insulation providing minimum R value of thickness within all wall cavities and attic spaces.

3.6 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.

C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.7 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072700 - FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes firestopping for the following:

1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
3. Sealant joints in fire-resistance-rated construction.

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

1. Division 3 Section "Cast-In-Place Concrete" for construction of openings in concrete slabs.
2. Division 4 Section "Unit Masonry" for joint fillers for non-fire-resistive-rated masonry construction.
3. Division 7 Section "Building Insulation" for safing insulation and accessories.
4. Division 7 Section "Joint Sealants" for non-fire-resistive-rated joint sealants.
5. Division 15 Sections specifying ducts and piping penetrations.
6. Division 16 Sections specifying cable and conduit penetrations.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:

1. Where firestop systems protect penetrations located outside of wall cavities.
2. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.
3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
4. Where firestop systems protect penetrating items larger than a 4 inch (100 mm) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined

per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

C. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

D. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

E. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:

1. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.

2. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water (2.5 Pa), as measured 0.78 inch (20 mm) from the face exposed to furnace fire. Provide systems complying with the following requirements:

a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.

B. Information on drawings referring to specific design designations of through-penetration firestop systems

is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

C. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design, and extent to that indicated for Project and that has performed successfully.

D. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.

E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials including the following:

a. Semirefractory fiber (mineral wool) insulation.
b. Ceramic fiber.
c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
d. Fire-rated formboard.
e. Joint fillers for joint sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.2 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.

B. Ceramic-Fiber Sealant: Single-component formulation of ceramic fibers and inorganic binders.

C. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.

D. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.

E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.

G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.

I. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.

K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

L. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

M. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Ceramic-Fiber and Mastic Coating:

   a. FireMaster Bulk and FireMaster Mastic, Thermal Ceramics.

2. Ceramic-Fiber Sealant:

   a. Metacaulk 525, The RectorSeal Corporation.

3. Endothermic, Latex Sealant:

   a. Fyre-Shield, Tremco Inc.

4. Endothermic, Latex Compounds:

   a. Flame-Safe FS500/600 Series, International Protective Coatings Corp.
   b. Flame-Safe FS900/FST900 Series, International Protective Coatings Corp.

5. Intumescent Latex Sealant:

   a. Metacaulk 950, The RectorSeal Corporation.
   b. Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.

6. Intumescent Putty:

   a. Pensil 500 Intumescent Putty, General Electric Co.
   b. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
   c. Fire Barrier Moldable Putty, 3M Fire Protection Products.

7. Intumescent Wrap Strips:

   a. Dow Corning Fire Stop Intumescent Wrap Strip 2002, Dow Corning Corp.
   b. CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.
   c. Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.

8. Job-Mixed Vinyl Compound:

   a. USG Firecode Compound, United States Gypsum Co.

9. Mortar:

   a. K-2 Firestop Mortar, Bio Fireshield, Inc.
   b. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.
   c. KBS-Mortar Seal, International Protective Coatings Corp.

10. Pillows/Bags:

    a. Firestop Pillows, Bio Fireshield, Inc.

b. KBS Sealbags, International Protective Coatings Corp.

11. Silicone Foams:

a. Dow Corning Fire Stop Foam 2001, Dow Corning Corp.
b. Pensil 200 Foam, General Electric Co.

12. Silicone Sealants:

a. Dow Corning Firestop Sealant 2000, Dow Corning Corp.
b. Dow Corning Firestop Sealant SL 2003, Dow Corning Corp.
c. Pensil 100 Firestop Sealant, General Electric Co.
d. CS240 Firestop Sealant, Hilti Construction Chemicals, Inc.
e. Metacaulk 835, The RectorSeal Corporation.
f. Metacaulk 880, The RectorSeal Corporation.
g. Fyre-Sil, Tremco Inc.
h. Fyre-Sil S/L, Tremco Inc.

13. Solvent-Release-Curing Intumescent Sealants:

a. Biostop 500 Intumescent Firestop Caulk, Bio Fireshield, Inc.
b. Fire Barrier CP 25N/S Caulk, 3M Fire Protection Products.
c. Fire Barrier CP 25S/L Caulk, 3M Fire Protection Products.

2.3 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

B. Sealant Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

C. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:

a. 50 percent movement in both extension and compression for a total of 100 percent movement.

D. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:

a. 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.

E. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

F. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

G. Products: Subject to compliance with requirements, provide one of the following:

1. Single-Component, Neutral-Curing, Silicone Sealant:

a. Dow Corning 790, Dow Corning Corp.
b. Dow Corning 795, Dow Corning Corp.
c. Silpruf, General Electric Co.
d. Ultraglaze, General Electric Co.
e. 864, Pecora Corp.

2. Multicomponent, Nonsag, Urethane Sealant:

a. Vulkem 922, Mameco International Inc.
b. Dynflex, Pecora Corp.
c. Dynatred, Pecora Corp.
d. Dynatrol II, Pecora Corp.
e. Sikaflex 2cn NS, Sika Corp.
f. Sonolastic NP 2, Sonneborn Building Products Div., ChemRex Inc.
g. Dymeric, Tremco Inc.

3. Single-Component, Nonsag, Urethane Sealant:

a. Isoflex 880 GB, Harry S. Peterson Co., Inc.
b. Isoflex 881, Harry S. Peterson Co., Inc.
c. Vulkem 921, Mameco International Inc.
d. Sikaflex--15LM, Sika Corp.

2.4 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint

substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.5 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 072700

SECTION 073116 - ROOF SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes asphalt/fiberglass shingles for pitched roofs.

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

1. Division 6 Section "Rough Carpentry" for wood sheathing.
2. Division 7 Section "Sheet Metal Flashing and Trim" for metal valley flashing, step flashing, drip edges, metal roof vents, and other sheet metal work.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product specified, including details of construction relative to materials, dimensions of individual components, profiles, textures, and colors.

C. Samples for initial selection in the form of manufacturer's sample finishes showing the full range of colors and profiles available for each type of asphalt shingle indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Classification: Where products with a fire-test-response classification are specified, provide asphalt shingles identical to those tested according to ASTM E 108 or UL 790 and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify each bundle of asphalt shingles with appropriate markings indicating fire-test-response classification of applicable testing and inspecting agency.

B. Wind-Resistance-Test Characteristics: Where wind-resistant asphalt shingles are indicated, provide products identical to those tested according to ASTM D 3161 or UL 997 and passed. Identify each bundle of asphalt shingles with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's unopened bundles or containers with labels intact.

B. Handle and store materials at Project site to prevent water damage, staining, or other physical damage. Store roll goods on end. Comply with manufacturer's recommendations for job-site storage, handling, and protection.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installing asphalt shingles only when existing and forecasted weather conditions will permit work to be performed according to manufacturers' recommendations and warranty requirements, and when substrate is completely dry.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace asphalt shingles that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, deformation or deterioration of asphalt shingles beyond normal weathering.

1. Warranty Period: Manufacturer's standard but not less than 30 years after date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Furnish 1 square (9.29 sq. m) coverage of asphalt/fiberglass shingles, identical to those to be installed, in unbroken bundles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering asphalt shingles that may be incorporated in the Work include, but are not limited to, the following:
1. Atlas Roofing Corp.
2. Bird, Inc.
3. BPCO, Inc.
4. (The) Celotex Corporation.
5. CertainTeed Corporation.
6. Custom Roofing Company.
7. Elk Corporation of America.
8. GAF Building Materials Corporation.
9. Georgia-Pacific Corp.
10. Globe Building Materials, Inc.
11. GS Roofing Products Co., Inc.
12. IKO Manufacturing, Inc.
13. (Herbert) Malarkey Roofing Co.
14. Owens-Corning Fiberglas Corp.
15. Pabco Roofing Products.
16. Tamko Asphalt Products, Inc.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Ridge Vents (concealed type/shingle overlay):

    a. Ridge Filter Shinglevent; Air Vent, Inc.
    b. Ridge Filtervent; Air Vent, Inc. (for Class A).
    c. Cobra Ridge Vent; GAF Building Materials Corporation.
    d. Roll Vent; Obdyke: Benjamin Obdyke, Inc.
    e. Trimline; Trimline Roof Ventilation Systems.

2. Synthetic Underlayment: Scrim-reinforced, polymer-based roof underlayment meeting ASTM D226, ASTM D2626, and D4869 physical property requirements.

    a. CertainTeed Diamond Deck
    b. GAF Deck Armor

3. Waterproof Underlayment (ice and water shield):

    a. WinterGuard; CertainTeed Corporation.
    b. Bituthene Ice and Water Shield; Grace: W.R. Grace & Co.
    c. Nordshield Ice and WaterGard; Nord Bitumi US, Inc.
    d. F210; Northern Elastomeric, Inc.
    e. Polyguard Deck Guard; Polyguard Products, Inc.
    f. Polyken 640 Underlayment Membrane; Polyken Technologies; Kendall Co. Division.
    g. QSC-707; Quaker Construction Products, Inc.
    h. Moisture Guard; Tamko Asphalt Products, Inc.

4. Shingles shall be installed over synthetic underlayment of ice and water shield as indicated on the contract drawings.

2.2 ROOF SHINGLES

A. Colors, Blends, and Patterns: Where manufacturer's standard products are indicated, provide asphalt shingles with the following requirements:

    1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for asphalt shingles of type indicated.

B. Heavyweight, Laminated, Fiberglass Shingles: Mineral-surfaced, self-sealing, laminated, multilayer, 3-dimensional, fiberglass shingles, equal to CertainTeed Landmark TL Ultimate. Provide shingles with a Class C fire-test-response classification that pass the wind-resistance-test requirements of ASTM D 3161 -03b, Class “F”.

    1. Wind Resistance: Passes the 110 MPH wind-resistance-test requirements of ASTM D 3161-03b, Class “F”.
    2. Fire-Test-Response Classification: Class A.
    3. UL 2218 Class 4, impact resistant and ASTM D 3018 Type 1.

C. Hip and Ridge Shingles: Manufacturer’s standard, factory-precut units to match asphalt shingles or job-fabricated units cut from actual asphalt shingles used.

2.3 METAL TRIM AND FLASHING

A. Sheet Metal Materials: Furnish the following sheet metal materials:

1. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003 H14 with mill finish, minimum 0.024 inch (0.6 mm) thick, unless otherwise indicated.
2. Galvanized-Steel Sheets: ASTM A 526, G 90 (ASTM A 526M), Z 275 hot-dip galvanized steel with coating designation according to ASTM A 525 (ASTM A 525M), mill phosphatized where indicated for painting; 0.0217 inch (0.55 mm) thick, unless otherwise indicated.

B. Metal Drip Edge: Brake-formed sheet metal with at least a 2-inch (50-mm) roof deck flange and a 1-1/2-inch (38-mm) fascia flange with a 3/8-inch (9.6-mm) drip at lower edge. Furnish the following material in lengths of 8 or 10 feet (2.5 to 3 m).

1. Material: Aluminum sheets.

C. Metal Flashing: Job-cut to sizes and configurations required.

1. Material: Aluminum sheets.

D. Open-Valley Metal Flashing: Preformed, inverted "V" profile at center of valley and extending at least 9 inches (230 mm) in each direction from centerline of valley.

1. Material: Aluminum sheets.
2. Material: Galvanized-steel sheets.

E. Vent Pipe Flashing: Lead conforming to ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick, unless otherwise indicated. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof extending at least 4 inches (100 mm) from pipe onto roof.

2.4 ACCESSORIES

A. Ridge Vent: High-density polypropylene, nonwoven modified polyester, or other UV-stabilized plastic designed to be installed under asphalt shingles at ridge.

B. Asphalt Plastic Cement: Nonasbestos fibrated asphalt cement, complying with ASTM D 4586.

C. Nails: Aluminum or hot-dip galvanized steel, 0.120-inch- (3-mm-) diameter barbed shank, sharp-pointed, conventional roofing nails with a minimum 3/8-inch- (9.5-mm-) diameter head and of sufficient length to penetrate 3/4 inch (19 mm) into solid decking or at least 1/8 inch (3 mm) through plywood sheathing.

1. Where nails are in contact with flashing, prevent galvanic action by providing nails made from the same metal as that of the flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate for compliance with requirements for substrates, installation tolerances, and other conditions affecting performance of asphalt shingles. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application. Cover knotholes or other minor voids in substrate with sheet metal flashing secured with noncorrosive roofing nails.

B. Coordinate installation with flashings and other adjoining work to ensure proper sequencing. Do not install roofing materials until all vent stacks and other penetrations through roof sheathing have been installed and are securely fastened against movement.

3.3 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations but not less than those recommended by ARMA's "Residential Asphalt Roofing Manual" or "The NRCA Steep Roofing Manual."

1. Fasten asphalt shingles to roof sheathing with nails.

B. Felt Underlayment: Apply 1 layer of felt underlayment horizontally over entire surface to receive asphalt shingles, lapping succeeding courses a minimum of 2 inches (50 mm), end laps a minimum of 4 inches (100 mm), and hips and valleys a minimum of 6 inches (150 mm). Fasten felt with sufficient number of roofing nails or noncorrosive staples to hold underlayment in place until asphalt shingle installation.

1. Omit felt underlayment at areas of waterproof underlayment. Lap felt underlayment over waterproof underlayment as recommended by manufacturer but not less than 2 inches (50 mm).

C. Waterproof Underlayment: Apply waterproof underlayment at eaves. Cover deck from eaves to at least 36 inches (600 mm) inside exterior wall line.

1. In addition to eaves, apply waterproof underlayment in place of felt underlayment at valleys.

D. Underlayment at Closed Valleys: Center a 36-inch- (900-mm-) wide felt underlayment in valley and secure with only enough nails to hold in place until asphalt shingles are installed. Lap roof underlayment over valley underlayment at least 6 inches (150 mm).

E. Metal Open Valleys: Comply with ARMA and NRCA recommendations. Install a second felt underlayment shingle lapped at least 12 inches (300 mm) and sealed with plastic asphalt cement. Install a metal valley shingle lapped at least 9 inches (225 mm) and sealed with plastic asphalt cement.

F. Woven and Closed-Cut Valleys: Comply with ARMA and NRCA recommendations.

G. Flashing: Install metal flashing and trim as indicated and according to details and recommendations of the "Asphalt Roofing" section of "The NRCA Steep Roofing Manual" and ARMA's "Residential Asphalt Roofing Manual."

H. Install asphalt shingles, beginning at roof's lower edge, with a starter strip of roll roofing or inverted asphalt shingles with tabs removed. Fasten asphalt shingles in the desired weather exposure pattern; use number of fasteners per shingle as recommended by manufacturer. Use vertical and horizontal chalk lines to ensure straight coursing.

1. Cut and fit asphalt shingles at valleys, ridges, and edges to provide maximum weather protection. Provide same weather exposure at ridges as specified for roof. Lap asphalt shingles at ridges to shed water away from direction of prevailing wind.
2. Use fasteners at ridges of sufficient length to penetrate sheathing as specified.
3. Pattern: 1/3 shingle spacing offset at succeeding courses.

I. Ridge Vents: Install ridge vents according to manufacturer's instructions.

3.4 ADJUSTING

A. Replace any damaged materials installed under this Section with new materials that meet specified requirements.

END OF SECTION 073116

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Formed roof drainage system.
2. Formed soil stack flashing.
3. Formed flashing for air handling unit.
4. Formed wall counter-flashing.
5. Formed through-deck flashings.
6. Pre-finished cladding over wood trim.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Carpentry" for wood nailers, curbs, and blocking.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weather-tight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and non-corrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. Aluminum Sheet: ASTM B 209 Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: One-side bright.

B. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

C. Exterior Cladding: .040 inch 48” x 96” Kynar 500 finish aluminum break metal sheets.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS & PREFABRICATIONS

A. Counter-flashings (curbs, walls, HVAC, hatches), Pitch Pans, : Fabricate from the following material:

1. Aluminum: 0.040 inch (0.8 mm) thick.

B. Roof-Penetration Flashing (Soil Stack) & Roof Drains: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

2.5 BREAK METAL CLADDING

A. Wrap all exposed surfaces of exterior wood trim with 0.40 thick Kynar 500 finish as detailed.

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Aluminum: Use aluminum or stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Counter-flashing, curbs, hatches, air handling units: Coordinate installation of counter-flashing with installation of base flashing. Insert counter-flashing in reglets, receivers or surface mounts and fit tightly to base flashing. Extend counter-flashing 4 inches over base flashing. Lap counter-flashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

C. Roof-Penetration Flashing (soil stacks): Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077123 - GUTTERS & DOWNSPOUTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Gutters and downspouts.

B. Related Sections include the following:

1. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, scuppers, gutters and downspouts, trim and fascia units, and miscellaneous sheet metal accessories.
2. Division 7 Section "Roof Accessories" for manufactured curbs, roof hatches, gravity ventilators, penthouse ventilators, ridge vents, and smoke vents. Roof accessories installed integrally with roofing membrane are specified in roofing system Sections as roofing work.

1.3 SUBMITTALS

A. Product Data: For each type of product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Indicate layout, joining, profiles, accessories, anchorage, flashing connections, and relationship to supporting structure and to adjoining roof and wall construction.

C. Samples for Initial Selection: Manufacturer's sample finishes showing the full range of colors and textures available for units with factory-applied color finishes.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide manufactured roof specialties capable of withstanding wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Provide manufactured roofing specialties, incorporating roof edge treatment that complies with recommendations of FM Loss Prevention Data Sheet 1-49 for the following Wind Zone:

1. Wind Zone 1: Wind pressures of 21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa).

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of manufactured roof specialty from one source and by a single manufacturer.

1.6 PROJECT CONDITIONS

A. Coordinate work of this Section with adjoining work for proper sequencing of each installation to ensure best-possible weather resistance and protection of materials and finishes against damage.

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:

1. Formed-Aluminum Gutters and Downspouts:

a. ABC Seamless, Inc.
b. Metal-Era, Inc.
c. MM Systems Corp.
d. National Sheet Metal Systems, Inc.

2.2 METALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 alloy and temper, or as recommended by manufacturer for use intended and as required for proper application of finish indicated.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for use intended and finish indicated, and with not less than the strength and durability of alloy and temper designated below:

1. Alloy 5005-H14, with a minimum thickness of 0.050 inch (1.2 mm), for aluminum sheet with other than mill finish.

2.3 GUTTERS AND DOWNSPOUTS

A. Provide gutters and downspouts in shapes and sizes indicated, with mitered and welded corners. Include steel straps formed from at least 0.028-inch- (0.7-mm-) thick, galvanized steel sheet; hangers or other attachment devices; screens; end plates; and trim and other accessories indicated or required for complete installation.

B. Additional Features: Provide items below fabricated from the same metal as gutters and downspouts.

1. Downspout starters (fascia sump) with downspout starter hole.
2. Leaf guard with hold-down clips.
3. Decorative collector boxes. Refer to the Architectural Drawings for exact sizes. Refer to the exterior building elevations.

C. Provide gutters and downspouts fabricated from the following metal:

1. Extruded aluminum in thickness indicated, but not less than 0.060 inch (1.5 mm).
2. 5" roll-formed “K” style gutter.
3. 5" wide x 5" deep style downspout.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessories designed and manufactured to match and fit roof edge treatment system indicated.

B. Exposed Fasteners: Stainless steel, nonmagnetic, of manufacturer's standard type and size for product and application indicated. Match finish of exposed heads with material being fastened.

C. Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.

D. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.

E. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

F. Foam-Rubber Seal: Manufacturer's standard foam.

G. Adhesives: Type recommended by manufacturer for substrate and project conditions, and formulated to withstand minimum 60-lbf/sq. ft. (2.9-kPa) wind-uplift force.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Finish manufactured roof specialties after fabrication and assembly if products are not fabricated from prefinished metals.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating or resin manufacturer's written instructions.

1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 1402, Test Method 7.

a. Color and Gloss: As selected by Architect from the manufacturer's standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, roof edges, and parapets for suitable conditions for roof edge system installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Promptly remove protective film, if any, from exposed surfaces of finished metals. Strip with care to avoid damage to finish.

B. Prepare concrete, concrete masonry block, cement plaster, and similar surfaces to receive roof edge system specified. Install blocking, cleats, water dams, and other anchoring and attachment accessories and devices required.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Coordinate with installation of roof deck and other substrates to receive work of this Section and with vapor retarders, roofing insulation, roofing membrane, flashing, and wall construction, as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor products securely to structural substrates to withstand lateral and thermal stresses and inward and outward loading pressures.

B. Isolation: Where metal surfaces of units contact dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces or provide other permanent separation as recommended by aluminum producer.

C. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation not only to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation, or damage.

D. Prior to installation contractor shall submit downspout locations to Architect for review and approval.

3.4 CLEANING AND PROTECTING

A. Clean exposed metal surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

B. Protection: Provide protective measures as required to ensure work of this Section will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION 077123

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:

a. Control and expansion joints in unit masonry.
b. Joints between different materials listed above.
c. Perimeter joints between materials listed above and frames of doors and windows.
d. Control and expansion joints in ceiling and overhead surfaces.
e. Other joints as indicated.

2. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Tile control and expansion joints.
d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
f. Perimeter joints of toilet fixtures.
g. Other joints as indicated.

3. Interior joints in horizontal traffic surfaces as indicated below:

a. Control and expansion joints in tile flooring.
b. Other joints as indicated.

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

1. Division 7 Section "Flashing and Sheet Metal" for sealing joints related to flashing and sheet metal for roofing.
2. Division 7 Section "Firestopping" for through-penetration firestopping systems.
3. Division 8 "Glass and Glazing" for sealants used in glazing.
4. Division 9 Section "Gypsum Board Assemblies" for sealing concealed perimeter joints of gypsum board partitions to reduce sound transmission.
5. Division 9 Section "Acoustical Panels" for sealing edge moldings at perimeter of acoustical ceilings.
6. Division 9 Section "Tile" for sealing tile joints.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealant product required.

1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

E. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General Sealer Performance Requirements: Provide colors indicated or, if not otherwise indicated, as selected by the Architect from manufacturer's standard bead samples, consisting of stipes of actual products showing a full range of colors. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicted select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicted. Where exposed to foot traffic, select marketing materials of sufficient strength and hardness to withstand stiletto heel traffic damage or deterioration of sealer system.

1. Elastomeric Sealants:

   a. Two-Component Polysulfide Sealant: Polysulfide-based, 2 part elastomeric sealant, complying with FS TT-S-227, Class A, Type II (non-sag) unless Type I recommended by manufacturer for application shown.
   b. Two-Component Polyurethane Sealant: Polyurethane-based, 2 part elastomeric sealant, complying with FS TT-S-00227, Class A, Type I (self-leveling) unless Type II recommended by manufacturer for application shown.
   c. One-Component Polysulfide Sealant: Polysulfide-based, 1-part elastomeric sealant, complying with FS TT-S-00230, Class A, Type II (non sag) unless Type I recommended by manufacturer for application shown.
   d. One-Component Polyurethane Sealant: Polyurethane-based, 1-part elastomeric sealant, complying with FS TT-S-00230, Class A, Type I (self-leveling) unless Type II recommended by manufacturer for application shown.

2. Non-Elastomeric Sealants:

   a. One-Component Acrylic Sealant: Acrylic terpolymer, solvent-based one-part, thermo-plastic sealant compound; solids not less than 95% acrylic; complying with FS TT-S-00230, Class B, Type II; recommended by manufacturer for general use as an exposed building construction sealant.
   b. Butyl Rubber Sealant: Polymerized butyl rubber and inert fillers (pigments), solvent-based with minimum 75% solids, non-sag consistency, tack-free time of 24 hours or less, paintable, non-staining; complying with FS TT-S-001657.

3. Cellular/Foam Joint Fillers:

a. Closed-Cell Synthetic Rubber Joint Filler: Provide expanded synthetic rubber complying with ASTM D 1056, Class Sc-E (oil-resistant and medium swell), of 2 to 5 psi compression deflection (Grade SCE 41); except provide 13 to 17 psi compression deflection (Grade SCE 44) where filler is applied under sealant exposed to traffic.
b. Closed-Cell PVC Joint Filler: Provide flexible expanded polyvinyl chloride complying with ASTM D 1667, Grade VE 41 BL (3.0 psi compression deflection); except provide higher compression deflection grades as my be necessary to withstand installation forces and provide proper support for sealants, if any.
c. Expanded Polyethylene Joint Filler: Provide flexible, compressible, closed-cell, polyethylene of not less than 10 psi compression deflection (25%); except provide higher compression deflection strength as may be necessary to withstand installation forces and provide proper support for sealants; surface water absorption of not more than 0.1 lbs. per sq. ft.
d. Open-Cell Polyurethane Joint Filler: Provide flexible, highly compressible, open-cell polyurethane foam of not less than 1.3 lbs. per cu. ft. density and not less than 2 psi compression deflection (25%), with not more than 10% compression set for 25 hours at 50% compression; comply with ASTM D 3574.

4. Miscellaneous Materials:

a. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.
b. Bond Breaker Type: Polyethylene tape or other plastic tape as recommended by sealant manufacturer to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.
c. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended by sealant manufacturer for compatibility with sealant.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

3.2 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of sealant or calking compound. Remove dirt, insecure coatings, moisture and other substances which could interfere with bond of sealant or calking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer.

B. Prime or seal joint surfaces where indicated, and where recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.3 INSTALLATION

A. Set joint filler units at proper depth or position in joint to coordinate with other work, including installation of bond breakers, back rods and sealants. Do not leave voids or gaps between ends of joint filler units.

B. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated.

C. Install bond breaker tape where indicated and where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

D. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

E. Install sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead:

1. For floor slabs and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.
2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
3. For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in range of 75% to 125% of joint width.

F. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

G. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

H. Bond ends of gaskets together with adhesive or "weld" by other means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners unless molded corner units are provided.

I. Sealant Type and Location:

1. Building Exterior Surfaces: Two component elastomeric sealants.
2. Building Interior Surfaces one component elastomeric or non-elastomeric sealants.

J. Joint Filler Type and Location:

1. Building walls and associated Areas: Sealant backer rod.

3.4 CURE AND PROTECTION

A. Cure sealants and calking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion.

END OF SECTION 079200

SECTION 081119 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes steel doors and frames, including door louvers, transom panels and sidelights.

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

1. Division 4 Section "Masonry".
2. Division 7 Section "Joint Sealer".
3. Division 8 Section "Glass and Glazing".
4. Division 8 Section "Finish Hardware".
5. Division 9 Section “Wall Board Assemblies”.
6. Division 9 Section “Painting”.

1.3 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently reference herein are referred to by issuing authority abbreviation and standard designation.

B. American Society for Testing and Materials (ASTM):

1. ASTM A 366 Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled.
2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A 924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
4. ASTM D610 Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces.
5. ASTM D714 Standard Test Method for Evaluating Degree of Blistering of Paints.
6. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
7. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
8. ASTM D1623 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
9. ASTM D1654 Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
10 ASTM D2126 Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
11. ASTM D2863 Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index).

C. American National Standards Institute (ANSI):

1. ANSI/DHI A115.IG Installation Guide for Doors and Hardware.
2. ANSI/SDI Standard A224.1 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors & Frames.
3. ANSI A250.8 Standard Steel Door Frames.

D. Federal Specification (Fed Spec):

1. Fed Spec C578Bead Fusion Test.

E. National Fire Protection Association (NFPA):

1. NFPA 80 Fire Doors and Windows.
2. NFPA 252 Fire Tests of Door Assemblies.

F. Underwriters Laboratories, Inc. (UL):

1. UL 10(b) and UL 10 (c) Fire Tests of Door Assemblies
2. UL Building Materials Director.

G. Warnock Hersey, Inc. (WHI):

1. WHI Directory of Listed Products.
2. WHI Directory of Positive Pressure Rated Door assemblies and components.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide metal doors and frames which have been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with the Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer’s SPEC-DATA product sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories and finish colors.

1. Indicate door type, frame, steel, core, material thickness, reinforcements, anchorages, exposed fasteners locations, openings (glazed, paneled or louvered) and hardware arrangement.
2. Include schedule identifying each unit, with door marks or numbers referencing numbering in schedules or drawings.

D. Samples: Submit selection and verification samples for finishes, colors and textures. Coordinate with Division 9 Painting Section for paint finishes.

E. Quality Assurance Submittals: Submit the following:

1. Certificates: Product certificates signed by manufacturer certifying that materials comply with specified performance characteristics and criteria and physical requirements.
2. Manufacturer's Instructions: Manufacturer's installation instructions.
3 Manufacturer's Field Reports: Manufacturer's field reports specified herein.

F. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in the installation of work similar to that required for this project.

1. Certificate: When requested, submit certificate indicating qualifications.

B. Regulatory Requirements:

1. Labeled Door and Frame Construction: Where noted or required, provide Underwriters Laboratories, Inc., (UL) or Warnock Hersey Inc. (WHI) labels with appropriate fire resistance and temperature rise ratings for class of opening indicated. Construction details and hardware applications authorized by testing or certification laboratories shall take precedence over project details or specifications.

C. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture, pattern and workmanship standards. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.

1. Mock-Up Size: 3 x 5.
2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up if it is no longer required.
3. Incorporation: Mock-up shall be incorporated into final construction upon Owner's approval.

D. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirements Sections, and with ANSI A250.8.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Handle and store products according to Amweld recommendations published in technical materials. Leave product wrapped or otherwise protected and under clean, dry storage conditions

until required.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

1. Door Storage: Doors shall be protected at corners to prevent damage or marring of finish. Doors shall be stored in an upright position under cover on building site on wood sills or on floors in a manner that will prevent rust and damage. Avoid creating a humidity chamber by using a plastic or canvas shelter and not venting the area covered.
2. Frame Storage: Frames shall be stored in an upright position under cover on building site on wood sills or on floors in a manner that will prevent rust and damage. Avoid creating a humidity chamber by using a plastic or canvas shelter and not venting the area covered.

1.8 PROJECT CONDITIONS

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

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. Warranty Period: 1 year commencing on Date of Substantial Completion for manufacture workmanship and defect. Lifetime warranty on the continuous welded edges of the door.

PART 2 - PRODUCTS

2.1 STEEL DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products.
2. Ceco Door Products.
3. Curries Company.
4. Steelcraft.

B. Sizes:

1. Standard Door Sizes: As indicated on drawings.

C. Fire Rating:

1. Provide doors and frames with UL or WHI listing (classification marks) where specified.

D. Sound Rating:

1. Provide sound transmission class of standard units tested as follows:

   a. 1 3/4" 18 Gauge Door: 31 STC.
   b. 1 3/4" 16 Gauge Door: 35 STC.

E. Finishes:

1. Exposed surfaces on doors and frames shall be cleaned, treated with a 3 stage iron phosphate and given 1 shop coat of synthetic resin, rust-inhibitive alkyd enamel primer. Prime paint shall be tested at a recognized independent testing laboratory in accordance with ANSI/SDI Standard A250.10 and meet the acceptance criteria outlined in that document (120 salt spray hours, 240 humidity hours, etc.).
2. Colors: Finish doors with gray primer paint, ready for field painting.

2.2 PRODUCT SUBSTITUTIONS

A. Substitutions: as permitted in Section 1.

2.3 MATERIALS

A. Steel Materials:

1. Cold-Rolled Steel: Comply with ASTM A 366 cold-rolled carbon steel sheet.
2. Galvanized Steel: Comply with ASTM A 924 general requirements for steel sheet metallic coated by hot dip process (formerly ASTM A525).

B. Primer Materials: Comply with ANSI A250.10 test procedures and acceptance criteria for prime painted steel surfaces for steel doors and frames.

C. Painted Finish Material: Comply with ANSI A250.3 test procedures and acceptance criteria for factory applied finish for steel doors and frames.

D. Door Color Paint Material: Provide manufacturer’s standard finish and color.

2.4 DOORS

A. General: Provide doors of sizes, 1 3/4" thickness and designs as scheduled with the following criteria:

1. Tops and bottoms of door shall not be less than 18 gauge galvanized channels. Tops shall be flush. Bottoms shall have inverted channel.
2. Sound and cold retardation shall be ensured by bonding a nominal 1 lb. density, procured rigid polystyrene foam core to the panels.
3. Doors shall be joined at the edge with a continuous welded seam using no filler material to create a smooth, unbroken surface for an acceptable seam on the edge.
4. Fabricate from two sheets of 14, 16, 18 and 20 gauge steel (ASTM A366) with no visible seams on either face.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level II and Physical Performance Level B (Heavy Duty) Full Flush type.
2. Steel thickness: 18 ga.

C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level III and Physical Performance Level A (Extra Heavy Duty), Full Flush type.
2. Steel thickness: 16 ga.

D. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lit indicated.

1. All vision lites shall be full flush type. No overlapping face edge accepted.

E. Labeled Doors: Where noted, provide Underwriters Laboratories, Inc. (UL) or Warnock Hersey Inc. (WHI) labels with appropriate fire resistance and temperature rise ratings for the class of opening indicated. Construction details and hardware applications authorized by labeling authorities shall take precedence over project details or specifications.

F. Hardware Locations: Unless otherwise specified, the location of locks, hinges, latches, push/pull plates and bars, exit devices, handle sets, closer reinforcings, roller latches and arm pulls shall conform to the recommendations of the Steel Door Institute.

G. Louvers: Provide factory installed insert type louvers with vision-proof inverted Y baffles. Louver blades shall be 18 gauge and frames shall be on 18 gauge welded steel construction.

H. Glazing: Provide doors with formed steel kits of screw-in type, to permit selection of secure side in field. Glazing arrangements shall accommodate 1/4" (6.4 mm) thick glass.

I. Prime Painted Doors: Exposed surfaces shall be cleaned, treated with a Bonderite chemical and given 1 baked-on shop coat of EPA compliant gray synthetic primer.

J. Prepainted Doors: Doors shall be chemically cleaned and treated with a Bonderite chemical. Doors shall receive a heavy coat of electrostatically applied finish paint, baked on. Finish paint shall be a durable formulation, made specifically for Amweld. Hard film shall provide good resistance to both mar and abrasion tests. Weather and chemical resistance shall be a property of the finish.

K. Transom Panels (Series 5500-5600 and 5700): Provide face sheets of 18 gauge steel (16 gauge optional). Panels shall be reinforced with a core bonded to faces with a thermosetting adhesive. When specified, a horizontal 12 gauge flat strip astragal shall be factory installed on transom panel.

2.5 MANUFACTURED FRAME UNITS

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.042-inch thick (18 gauge) steel sheet for:

1. Level I steel doors.
2. Wood doors.

C. Frames of 0.053-inch thick (16 gauge) steel sheet for:

1. Door openings wider than 48 inches.
2. Level I steel doors.

3. Level II steel doors.
4. Level III steel doors, unless otherwise indicated.
5. Wood doors, unless otherwise indicated.

D. Frames of 0.067-inch thick (14 gauge) steel sheet for:

1. Level III steel doors, unless otherwise indicated.
2. Level IV steel doors, unless otherwise indicated.
3. Wood doors, unless otherwise indicated.

E. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

F. Plaster Guards: Provide 0.016-inch- thick steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

G. Supports and Anchors: Fabricated from not less than 0.045-inch-thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.

H. Inserts, Bolts, and Fasteners: Manufacturer’s standard units. Where zinc-coated items are to be built into exterior walls, complying with ASTM A 152/A 153M, Class C or D as applicable.

I. Frame minimum steel thickness: Interior - 16 ga., Exterior - 14 ga.

J. Provide ½" thick by 1-3/4" wide full height filler strip of styrofoam behind hinge jamb to allow for drilling and topping for continuous hinge in field.

K. Metal Door Frames: Fabricate from 16 or 14 gauge steel (ASTM A366) for 1 3/4" (45 mm) doors and 16 gauge for 1 3/8" (35 mm) doors. Frames shall be designed with integral stop and trim. Mitered corners shall be reinforced with 18 gauge channel shaped Inter-Lok reinforcements. Knocked-down frames shall have self-aligning tabs and slots for securely locked corners. Welded frame corners shall be mitered, arc welded and ground smooth per ANSI A250.8.

L. Masonry: Equip frames with 1 welded in floor anchor in each jamb. Provide 3 field inserted steel lock-in or welded-in anchors (maximum of 24" (610 mm) oc) for each jamb. Anchors shall be type for particular construction involved (i.e., wood stud, masonry or steel stud).

M. Drywall Frames: Design frames for installation after wall is erected. Provide hinge and strike jambs with welded-in compression anchors which are to be screw adjusted after frame is installed to maintain a tight grip on wall and shall be equipped with welded-in sill anchors. Provide 16 gauge frames.

N. Hardware Preparation: Frames shall be mortised, reinforced, drilled and tapped to receive specified mortise hardware and reinforced only for specified surface hardware. Drilling and tapping for surface hardware shall be done in the field. Plaster guards shall be installed on applicable hardware cutouts in 400 Series frames. Strike jambs shall be prepared for 3 rubber silencers.

O. Labeled Frames: When noted or required, provide for frame, windows and/or transoms and sidelights Underwriters Laboratories, Inc. (UL) or Warnock Hersey Inc. (WHI) labels for class of opening indicated. Construction details and hardware applications authorized by labeling authorities shall take precedence over project details or specifications.

P. Galvanized Option: Provide frame members of ASTM A40 hot dipped 16 or 14 gauge galvanized materials in 0.4 oz class conforming to ASTM A924 and A653. Treat materials in mill to ensure superior prime paint adhesion.

Q. Prime Panted Frames: Exposed surfaces shall be cleaned, treated with Bonderite chemical and given 1 baked-on shop coat of EPA compliant gray synthetic primer.

R. Prepainted Frames: Frames shall be chemically cleaned and treated with a Bonderite chemical, plus a heavy coat of electrostatically applied baked on finish paint. Finish paint shall be a durable formulation, made specifically for Amweld. Hard film shall provide good resistance to both mar and abrasion tests. Weather and chemical resistance shall be a property of finish.

2.6 RELATED MATERIALS

A. Related Materials: Refer to other sections listed under Related Sections for related materials.

2.7 SOURCE QUALITY

A. Source Quality: Obtain metal door and frame products from a single manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

1. Verify that door frame openings are installed plumb, true and level before beginning installation process. Select fasteners of adequate type, number and quality to perform the intended functions.

3.3 PREPARATION

A. Surface Preparation:

1. Preparation for Field Painting: Before application of finish coat of paint, surfaces must be dry and free to dirt, oil and dust. Finish coat shall be applied over a film which is intact. Scratches or bare edges shall be field primed with a rust inhibiting paint before top coating. Comply with instructions on finish coat application provided by paint manufacturer.

3.4 INSTALLATION

A. General:

1. Set frame product plumb, square, aligned and without twist at correct elevation.
2. Frame Installation: Install pressed steel frames. Installation shall be plumb, straight and true, rigidly secured in place, and properly braced. Comply with ANSI/DHI A115-IG installation guide.

B. Frame Installation Tolerances: Plumbness tolerance (measured through a line from intersecting corner of vertical members and the head to the floor) + 0.063" (1.6 mm).

1. Squareness tolerance (measured through a line 90 degrees from one jamb at upper corner of product, to opposite jamb): + 0.063" (1.6 mm).
2. Alignment tolerance (measured on jambs, through a horizontal line parallel to plane of wall): + 0.063" (1.6 mm).
3. Twist tolerance (measured at face corners of jambs, on parallel lines perpendicular to plane of wall) + 0.063" (1.6 mm).

C. Installation:

1. Secure anchorages and connections to adjacent construction.
2. Install hardware in accordance with manufacturer's templates and instructions.
3. Finish exposed field welds to present a smooth uniform surface. Touch up with a rust inhibitive primer.
4. Touch up exposed surfaces scratched or marred during shipment, installation or handling with a rust inhibitive primer.
5. Install glazing materials and door silencers.

D. Installation Reference Standard(s): Install metal doors and frames in accordance with requirements of applicable reference standards.

1. Comply with Door and Hardware Institute (DHI) installation standards.
2. Comply with Steel Door Institute (SDI) installation and maintenance standards.
3. Comply with NFPA80 installation standards.

E. Fire Rated Construction:

1. Regulatory Requirements: Install fire labeled steel door and frame product in accordance with NFPA80, current edition, unless specified otherwise.

F. Related Products Installation: Refer to other sections listed under Related Sections for related products installation.

3.5 FIELD QUALITY REQUIREMENTS

A. Door Supplier's Field Services: Upon Owner's request, provide Door Supplier's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 ADJUSTING

A. Adjusting: Adjust hinge sets, locksets and other hardware. Lubricate using a suitable lubricant compatible with door and frame coatings.

3.7 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.8 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 081119

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.

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, trim for openings, and louvers.

1. 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 dimensions and locations of cutouts.
2. Indicate requirements for veneer matching.
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 with transparent finish. Show the full range of colors available for stained finishes.
2. Faces of factory-finished doors with opaque finish. Show the full range of colors available.

D. Samples for Verification: As follows:

1. Corner sections of doors approximately 8 by 10 inches (200 by 250 mm) with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with the following standard:

1. AWI Quality Standard: AWI's "Architectural Woodwork Quality Standards" for grade of door, core, construction, finish, and other requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

1. Individually package doors in plastic bags or cardboard cartons.
2. Individually package doors in cardboard cartons and wrap bundles of doors in plastic sheeting.

B. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.7 WARRANTY

A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not comply with tolerances in referenced quality standard.

1. Warranty shall be in effect during the following period of time after the 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:

1. Flush Wood Doors:

a. Algoma Hardwoods Inc.

b. Buell Door Co.
c. Chappell Door Co.
d. Eggers Industries; Architectural Door Division.
e. Graham Manufacturing Corp.
f. V-T Industries Inc.
g. Weyerhaeuser Co.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish: Comply with the following requirements:

1. Grade: Custom, with Grade AA faces.
2. Faces: Red oak, plain sliced.
3. Match between Veneer Leaves: Random match.
4. Match within Door Faces: Running match.
5. Pair and Set Match: Provide for pairs of doors and for doors hung in adjacent sets.
6. Stiles: Same species as face.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking at particleboard-core doors as follows:

a. 5-inch (125-mm) top-rail blocking, at doors indicated to have closers.
b. 5-inch (125-mm) bottom-rail blocking, at exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch (125-mm) midrail blocking, at doors indicated to have exit devices.

B. Interior Veneer-Faced Doors: Comply with the following requirements:

1. Core: Particleboard core.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

2.4 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 of 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.

2.5 SHOP PRIMING

A. Transparent Finish: Shop seal faces and edges of doors for transparent finish with stain (if required), other required pretreatments, and first coat of finish as specified in the following:

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard's requirements for factory finishing.

B. Finish wood doors at factory.

C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.

1. Grade: Premium.
2. Finish: Manufacturer’s standard finish with performance requirements comparable to AWI System TR-6 Catalyzed polyurethane.
3. Staining: Staining: As selected by Architect from manufacturer’s full range of colors.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine 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 plumb jambs and level heads.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install wood 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.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at Project site.

3.3 ADJUSTING AND PROTECTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of access doors:

1. Wall access doors.
2. Ceiling access doors.

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

1. Division 4 Sections for building in anchors and grouting frames set in masonry construction.
2. Division 15 Section "Duct Accessories" for duct access doors.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).

1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

C. Shop drawings showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Acudor Products Inc.
2. Cierra Products
3. Karp Associates, Inc.
4. Larsen's Manufacturing Co.
5. Nystrom, Inc.
6. The Williams Bros. Corporation of America.

2.2 MATERIALS

A. Steel Sheet: ASTM A 366 (ASTM A 366M) commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.

2.3 ACCESS DOORS

A. Flush Access Doors with Exposed Trim for Masonry: Units consisting of frame with exposed trim, door, hardware, and complying with the following requirements:

1. Frame: 16 GA (min) cold-rolled steel
2. Door: 20 GA (min) cold-rolled steel.
3. Trim: Flange integral with frame, 1 inch (25.4 mm) wide, overlapping surrounding finished surface.
4. Hinge: Continuous type.
5. Locks: Flush, screwdriver-operated cam.

B. Trimless, Flush Insulated Access Doors for Gypsum Board: Units consisting of frame, concealed edge trim, door, hardware, and complying with the following requirements:

1. Frame: 0.067-inch- thick steel sheet.
2. Door: 0.050-inch- thick steel sheet. Provide 1" thick rock wool insulation.
3. Concealed, Gypsum Board Edge Trim: 0.0299-inch (0.76-mm) zinc-coated or galvanized-steel sheet with face flange formed to receive joint compound.
4. Hinge: Concealed spring pin or continuous type.
5. Locks: Screwdriver-operated cam.

2.4 FABRICATION

A. General: Manufacture each access door assembly as an integral unit ready for installation.

B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flange: Nominal 1 to 1-1/2 inches (25.4 to 38.1 mm) wide around perimeter of frame.
2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.

3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.

C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.

PART 3 - EXECUTION

2.3 PREPARATION

A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

2.4 INSTALLATION

A. Comply with manufacturer's instructions for installing access doors.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.

C. Install concealed-frame access doors flush with adjacent finish surfaces.

2.5 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 084113 - ALUMINUM ENTRANCES, STOREFRONTS, AND WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Extent of aluminum entrances is indicated on drawings and schedules. Contractor shall verify in field all openings prior to fabrication.

B. Aluminum entrances, storefronts types required for the project include:

1. Exterior and interior entrance doors.
2. Frames for exterior and interior entrances.

C. Glazing: Refer to “Glass and Glazing” Section of Division 8 for glazing requirements for aluminum entrances and storefronts, including doors specified to be factory-preglazed.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide aluminum entrance and storefront assemblies that comply with specified performance characteristics. Each system shall be tested by a recognized testing laboratory or agency in accordance with specified test methods. Provide certified test results.

B. Thermal Movement: Provide systems capable of withstanding thermal movements resulting from an ambient temperature range of 120E F (67EC), that could cause a metal surface temperature range of 180E F (100EC) within the framing system.

C. Wind Loading: Provide assemblies capable of withstanding a uniform test pressure of 20 psf inward and 20 psf outward when tested in accordance with ASTM E 330.

D. Fixed Framing Transmission Characteristics: Provide aluminum entrance and storefront framing system that complies with requirements indicated for transmission characteristics.

1. Air Infiltration: Provide framing system with an air infiltration rate of not more than 0.06 CFM per sq. ft. of fixed area (excluding operable door edges) when tested in accordance with ASTM E 283 at an inward test pressure differential of 6.24 psf.
2. Water Penetration: Provide framing system with no water penetration (excluding operable door edges) as defined in the test method when tested in accordance with ASTM E 331 at an inward test pressure differential of 6.24 lfb. per sq. ft.
3. Condensation Resistance: Where framing systems are “thermal-break” construction, provide units tested for thermal performance in accordance with AAMA 1502 showing condensation resistance factor (CRF) of not less than 45.
4. Thermal Transmittance: Provide framing systems that have an overall U-valve of not more than 0.65 BTU/(hr. x sg. ft. X deg. F) at 15 mph exterior wind velocity when tested in accordance with AAMA 1503.

E. Aluminum Entrance Transmission Characteristics: Provide entrance doors with jamb and head frames that comply with requirements indicated for transmission characteristics.

1. Air Infiltration: Provide doors with an air infiltration rate of not more than 0.50 CFM for single doors and 1.0 for pairs of doors when tested in accordance with ASTM E 283 at an inward test pressure differential of 1.567 psf.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications, technical product data, standard details, and installation recommendations for each type of entrance and storefront product required. Include the following information:

1. Fabrication methods.
2. Finishing.
3. Accessories.

B. Shop Drawings: Submit shop drawings for fabrication and installation of entrances and storefronts, include the following:

1. Elevations.
2. Detail sections of typical composite members.
3. Hardware, mounting heights.
4. Anchorages and reinforcements.
5. Glazing details.

C. Samples: Submit pairs of samples of each type and color of aluminum finish, on 12" long sections of extrusions or formed shapes and on 6" square sheets. Where color or texture variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of variations.

D. Certification: Provide certified test results showing that entrance and storefront systems have been tested by a recognized testing laboratory or agency and comply with specified performance characteristics.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications: Entrances and storefront shall be installed by a firm that has not less than 5-years successful experience in the installation of systems similar to those required.

B. Design Criteria: Drawings are based on one manufacturer's entrance and storefront system. Another manufacturer's system of a similar and equivalent nature will be acceptable when, in the Architect's sole judgment, differences do not materially detract from the design concept or intended performance.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check openings by field measurement before fabrication to ensure proper fitting of work; show measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in the work. Where necessary, proceed with fabrication without field measurement, and coordinate fabrication tolerances to ensure proper fit.

1.7 WARRANTY

A. Special Product Warranty: Submit a written warranty, executed by the Contractor, Installer and Manufacturer, agreeing to repair or replace units (including reglazing) which fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation,

and deterioration of metals, metal finishes and other materials beyond normal weathering. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1. Warranty period for aluminum entrances and storefront in 3 years after the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide Kawneer Model 500, Wide Stile Swing Doors, with Kawneer Trifab II 451T framing system or approved equal for the entrance and fixed framing elements, or approved equal from one of the following:

1. United States Aluminum.
2. Tubelite.
3. YKK

2.2 MATERIALS

A. Aluminum Members: Provide alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for extrusions and ASTM B 209 for sheet or plate.

B. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, or other materials warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.

1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125" thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.

C. Concealed Flashing: Provide 26 gage minimum dead-soft stainless steel, or 0.026" minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components.

D. Brackets and Reinforcements: Where feasible, provide high-strength aluminum brackets and reinforcements; otherwise provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.

E. Concrete/Masonry Inserts: Provide concrete and masonry inserts fabricated from cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386.

F. Compression Weatherstripping: Provide the manufacturer’s standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.

G. Sliding Weatherstripping: Provide the manufacturer’s standard replaceable weatherstripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.

H. Glass and Glazing Materials: Glass and glazing materials shall comply with requirements of “Glass and Glazing” section of these specifications.

I. Aluminum for Windows and Components.

1. Extruded aluminum profiles shall be 6063 T5 alloy and temper (ASTM B221 G.S 10A-T5).
2. The frame and vent depth shall be not less than 2 1/4" (57.2).
3. All framing members shall have minimum wall thickness of .090" (2.3) and shall provide the structural strength sufficient to meet the specified performance requirements.
4. All references to dimensions for wall thicknesses and other cross-sectional dimensions of window members are nominal and in compliance with ANSI H35.2-1990.
5. All glass pockets, fixed, and ventilators shall be weeped to provide positive drainage. Water shall be weeped to the exterior via frame weep slots protected by a hooded cover or integral drips.

J. Thermal Barrier

1. The thermal barrier shall be Kawneer Isolock® with a minimum 3/8" (9.5) separation consisting of a two-part, chemically curing high density polyurethane which is mechanically and adhesively bonded to the aluminum.

2.3 COMPONENTS

A. Storefront Framing System: Provide inside-outside matched resilient flush-glazed storefront framing system with provisions for glass replacement. Shop-fabricate and preassemble frame components where possible.

1. Thermal-Break Construction: Fabricate storefront framing system in integrally concealed, low conductance thermal barrier, located between exterior materials and exposed interior members to eliminate direct metal-to-metal contact. Use manufacturer's standard construction that has been in use for similar projects for period of not less than 3 years.

B. Aluminum Door Frames: Fabricate tubular and channel frame assemblies, as indicated, with welded or mechanical joints in accordance with manufacturer's standards; reinforce as necessary to support required loads.

C. Stile-and Rail Type Aluminum Doors:

1. Frame: Provide tubular frame members, fabricated with dual moment welded corner construction.
2. Design: Provide 1-3/4" thick doors of design indicated.

a. 5" wide stile.
b. 6" wide top rail and 10" high bottom rail

3. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal. Provide surface applied muttins/dividers as detailed on drawings.

D. Fasteners:

1. Fasteners, where exposed, shall be 300 series stainless steel.
2. Perimeter anchors shall be aluminum or steel, providing the steel is properly separated from the aluminum.

E. Glazing Materials:

1. Glazing materials shall be compatible with aluminum and those sealants and sealing materials used in composite structure which have direct contact with the gasket.
2. Standard exterior and interior glazing gaskets shall be a dry glazed elastomer in accordance with ASTM C509-91.
3. Interior air sealants shall be silicone and shall meet AAMA 802.5-92 (Type II).

4. Glazing beads shall be extruded aluminum and shall be a minimum thickness of .050" (1.3).
5. Frames shall be weatherstripped with a resilient foam core cladded with UV-resistant elastomer.

F. Glass and Glazing:

1. Glass thickness and type shall be based on the manufacturer's recommendations for specified design pressure.
2. All glass thicknesses shall be as specified herein.
3. Standard factory glazing shall be as specified.
4. Annealed glass installed in windows shall meet ASTM C 1036-91.
5. Sealed insulating glass, where used, shall conform to ASTM E774-88, "A" Level.
6. Safety Glazing materials, where used, shall conform to ANSI Z97.1-1984 or CPSC 16 CRF 1201-1986.
7. Tempered glass, where used, shall conform to ASTM C 1043-91.
8. Provide surface-mounted muttins (dividers) as detailed on the drawings.

2.4 HARDWARE

A. General: Refer to hardware section in Division 8 for requirements for hardware items other than those indicated to be provided by the aluminum entrance manufacturer.

2.5 FABRICATION

A. General: Sizes of door and frame units, and profile requirements, are indicted on drawings. Variable dimensions are indicated, with maximum and minimum dimensions require to achieve design requirements and coordination with other work.

B. Prefabrication: Before shipment to the project site, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble components only as necessary for shipment and installation.

1. Preglaze door and frame units to greatest extent possible.
2. Do not drill and tap for surface-mounted hardware items until time of installation of project site.
3. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.

C. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.

D. Reinforcing: Install reinforcing as required for hardware and necessary for performance requirements, sag resistance and rigidity.

E. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator that will prevent corrosion.

F. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contracting members.

1. Uniformity of Finish: Abutting extruding aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair sumbmittal.

G. Fasteners: Conceal fasteners wherever possible.

H. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops; at other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.

1. Provide EPDM or vinyl blade gasket weatherstripping in bottom door rail,a djustable for contact with threshold.
2. At interior doors and other locations without weatherstripping, provide neoprene silencers on stops to prevent metal-to-metal contact.
3. Provide finger guards of collapsible neoprene or PVC gasketing securely anchored into frame at hinge-jamb of center-pivoted doors.

2.6 FINISHES

A. Color Anodized Finish: Provide NAAMM AA=M12C22A41/A44, Class I (non-Specular as fabricated mechanical finish; chemical etch, medium matte; minimum thickness 0.7 mil) integrally or electrolytically deposited colored anodic coating.

1. Color: Dark Bronze #40.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation.

B. Set nits plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Provide proper support and anchor securely in place.

1. Separate aluminum and other corrodible metal surfaces from sources of corrosion of electrolytic action at points of contact with other material. Comply with requirements specified under paragraph "Dissimilar Materials" in the Appendix to AAMA 101-85.

C. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

D. Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 7 for sealant fillers, and gaskets.

E. Refer to "Glass and Glazing" section of Division 8 for installation of glass and other panels indicated to be glazed into doors and framing, and not preglazed by manufacturer.

END OF SECTION 084113

SECTION 085200 - WOOD WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following wood-windows:

1. Double hung windows.

B. Related Sections include the following:

1. Division 6 Section "Finish Carpentry" for interior and exterior wood trim not included as part of wood window units.

1.3 DEFINITIONS

A. Performance-grade number, included as part of the window designation system, is the actual design pressure in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

1. Structural test pressure, wind-load test, is equivalent to 150 percent of the design pressure.
2. Water-leakage-resistance test pressure is equivalent to 10 percent of the design pressure with 2.86 lbf/sq. ft. (137 Pa) as a minimum.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide wood windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, and sizes required for this Project according to test methods indicated.

B. Standards: Performance requirements for operating force, air infiltration, water penetration, structural performance, and forced-entry resistance for wood windows are those specified in NWWDA I.S. 2, "Industry Standard for Wood Window Units."

C. Test Criteria: Testing shall be performed by a qualified independent testing agency based on the following criteria:

1. Design wind velocity at Project site is 70 mph (113 km/h).
2. Heights of window units above grade at the window centerline are indicated or can be determined from the Drawings. Consult with the Architect, if necessary, to confirm required loading and test pressures.
3. Test Procedures: Test window units according to ASTM E 283 for air infiltration, ASTM E 547 for water penetration, and ASTM E 330 for structural performance.

D. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in NWWDA I.S. 2 for operating force, air infiltration, water penetration, structural performance, and forced-entry resistance for the type and performance grade of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of NWWDA I.S. 2, Article 6, "Optional Performance Classifications," for higher than minimum performance grades.

1. Operating Force: The amount of force required to start and to maintain the sash in motion shall not exceed 25 lbf (111 N).
2. Air-Infiltration Rate for Operating Units: Not more than 0.37 cfm/ft. (2.06 cu. m/h per m) of operable sash joint for an inward test pressure of 1.57 lbf/sq. ft. (75 Pa).
3. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 10 percent of the structural test pressure.
4. Structural Performance: No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for a positive (inward) and negative (outward) test pressure of 22.5 lbf/sq. ft. (1077 Pa).
5. Thermal Transmittance: Provide window units, labeled and certified according to the National Fenestration Rating Council's Product Certification Program, with the following U-value as determined according to NFRC 100.

    a. U-Value: 0.56 Btu/sq. ft. x h x deg F (3.18 W/sq. m x K) for operable, double-glazed, vinyl-clad, wood window units.
    b. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.

1.5 SUBMITTALS

A. Product Data: For each type of wood window required. Include the following:

1. Construction details and fabrication methods.
2. Profiles and dimensions of individual components.
3. Data on hardware, accessories, and finishes.
4. Recommendations for maintenance and cleaning of exterior surfaces.

B. Shop Drawings: For each type of window required. Include information not fully detailed in manufacturer's standard Product Data and the following:

1. Layout and installation details, including anchors.
2. Elevations at 1/4 inch = 1 foot (1:50) scale and typical window unit elevations at 3/4 inch = 1 foot (1:20) scale.
3. Full-size section details of typical composite members, including reinforcement and stiffeners.
4. Hardware, including operators.
5. Glazing details.
6. Accessories.

C. Samples for Initial Selection: One 12-inch- (300-mm-) long section of window members. Where finishes involve normal color variations, include Sample sets showing the full range of variations expected.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms whose windows have been certified under NWWDA's "Hallmark Program" for wood window units are listed in the current NWWDA "Membership and Product Directory" and comply with requirements indicated.

1. Provide only wood window units bearing an NWWDA "Hallmark Program" label certifying compliance with NWWDA I.S. 2.

B. Source Limitations: Obtain wood window units through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, dimensional requirements, and aesthetic effects of wood windows and are based on the specific window types and models indicated. Other manufacturers' products with equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect. Refer to Division 1 Section "Substitutions."

D. Safety Glass Standard: Provide products complying with testing requirements of 16 CFR, Part 1201 for Category II materials.

1. Subject to compliance with requirements, provide safety glass permanently marked with the certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

E. Glazing Standards: Comply with recommendations of GANA's "Glazing Manual" and "Sealant Manual," unless more stringent requirements are indicated.

F. Insulating-Glass Certification Program: Provide insulating-glass units permanently marked on spacers or at least on one component pane of units with the appropriate certification label of the inspecting agency indicated below:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. National Certification Testing Laboratories.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify window openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by wood window manufacturer, agreeing to repair or replace window components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures, including excessive deflection, water leakage, air infiltration, or condensation.
2. Faulty operation of sash and hardware.
3. Deterioration of finishes and other materials beyond normal weathering.

C. Warranty Period for Insulating Glass: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide window units by one of the following:
1. Anderson Vinyl-Clad 400 Series Wood Window Units (tilt-out double hung):

a. Andersen Corp.
b. Pella Corporation.
c. Marvin Windows

2.2 MATERIALS

A. General: Comply with NWWDA I.S. 2.

B. Wood: Clear ponderosa pine or other suitable fine-grain lumber, kiln dried to a moisture content of 6 to 12 percent at time of fabrication and free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm wide by 2 inches (51 mm long.

1. Lumber shall be water-repellent preservative treated after machining per NWWDA I.S. 4.

C. Vinyl Cladding: Manufacturer's standard vinyl cladding, consisting of a rigid PVC sheath, complying with ASTM D 1784, Class 14344-C, not less than 35-mil (0.9-mm average thickness, in permanent white paintable finish, mechanically bonded to exterior wood sash and frame members.

D. Anchors, Clips, and Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633 for SC 3 (severe) service condition; provide sufficient strength to withstand design pressure indicated.

E. Fasteners: Comply with NWWDA I.S. 2 for fabrication and with manufacturer's recommendations and standard industry practices for type and size of installation fasteners.

1. Use zinc-coated or nonferrous nails and screws for window fabrication and installation.
2. Use brass screws for hardware and accessory installation.

F. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when sash is closed.

1. Weather-Stripping Material: Molded PVC gaskets complying with ASTM D 2287.

G. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.2.

1. Provide weather stripping with integral, centerline barrier fin of semi-rigid, plastic, polypropylene.

H. Wire-Fabric Insect Screen: 18-by-14 (1.2-by-1.6-mm or 18-by-16(1.2-by-1.4-mm mesh of 0.013-inch-(0.3-mm- diameter, coated aluminum wire, complying with FS RR-W-365, Type VII.

I. Glass and Glazing Materials: Provide manufacturer's standard clear, sealed, insulating low-E glazing material that complies with Division 8 Section "Glazing.

J. Glazing Seal: Provide manufacturer's standard extruded, vinyl, or butyl glazing gasket providing weathertight seal.

K. Color: Interior and exterior finish shall be Dark Bronze.

2.3 HARDWARE

A. General: Provide manufacturer's standard hardware, necessary to operate, tightly close, and securely lock windows. Do not use aluminum in frictional contact with other metals.

1. Provide solid white or stone metal hardware with a special coating finish and plated steel or brass/bronze operating bars and rods. (Architect to select).

B. Four-Bar Friction Hinges: Comply with AAMA 904.1.

1. Friction Shoes: Nylon or other nonabrasive, nonstaining, noncorrosive, durable material.

C. Gear-Type Rotary Operators: Comply with AAMA 901.1 for rotary operators. Comply with ASTM E 405, Method A, when subjected to operating moments and closing torques indicated in AAMA 101.

1. Operator shall operate all ventilators simultaneously, securely closing them at both jambs without using additional manually controlled locking devices.

D. Push-Bar-Type Operators: Telescoping-type push-bar operator designed to open and close ventilators with fixed screens.

E. Counterbalancing Mechanism: Comply with AAMA 902.2.

1. Sash-Balance Type: Concealed block-and-tackle type of size and capacity to hold sash stationary at any open position.

2.4 ACCESSORIES

A. Insect Screens: Provide insect screens for each operable exterior sash or ventilator. Locate screens on inside or outside of window sash or ventilator, depending on window type. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches.

1. Screen Frames: Fabricate frames of tubular-shaped, extruded- or formed-aluminum members of 0.040-inch- (1-mm- minimum wall thickness, with mitered or coped joints and concealed mechanical fasteners. Provide removable PVC spline/anchor concealing edge of screen frame. Comply with SMA 1004.

a. Finish: Match window members.

2.5 DOUBLE HUNG WINDOWS

A. Window Grade: Comply with requirements of NWWDA Performance Grade DP15.

B. Grilles:

1. Provide internal and external grilles for window units. Finish as selected by Architect from a full range of colors and finishes.

2.6 FABRICATION

A. General: Fabricate wood window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.

1. Comply with requirements of NWWDA I.S. 2 for moisture content of lumber at time of fabrication.

B. Fabricate windows to produce units that are reglazable without dismantling sash framing. Provide openings and mortises precut, where possible, to receive hardware and other items.

1. Provide weather stripping at perimeter of each operating sash.

a. For double-hung sash, provide weather stripping only at horizontal rails of operable sash.

2. Provide removable insect screen for each operating sash, with location determined by manufacturer.
3. Provide glazing stops, nailed or snap-on type, coordinated with glass selection and glazing system indicated.
4. Factory-Glazed Window Units: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze window units in the factory before delivery, unless factory glazing is not available from manufacturer. Comply with requirements of Division 8 Section "Glazing" of these Specifications and NWWDA I.S. 2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings before installation. Verify that opening is correct and sill plate is level. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Masonry surfaces shall be dry and free of construction debris.
2. Wood frame walls shall be dry, clean, sound, well-nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (75 mm) of corner.
3. Coordinate window installation with wall flashings and other built-in components.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions and recommendations for installing window units, hardware, operators, accessories, and other components of the Work.

B. Set window units level, plumb, true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.

C. Set sill members in a bed of sealant or with joint fillers or gaskets, as indicated, to provide weathertight construction.

3.3 ADJUSTING

A. Adjust operating sash and hardware to provide a tight fit at contact points and weather stripping for smooth operation and a weathertight closure. Lubricate hardware and moving parts.

3.4 CLEANING

A. Clean interior and exterior surfaces immediately after installation. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealants, dirt, and other substances.

B. Clean glass of factory-glazed units immediately after installing windows. Wash and polish glass on both faces before Substantial Completion. Comply with manufacturer's recommendations for final cleaning and maintenance. Remove nonpermanent labels from glass surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.

3.5 PROTECTION

A. Protect window units from damage or deterioration until the time of Substantial Completion.

END OF SECTION 085200

SECTION 087100 - FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:

1. Furnish hardware required to complete the work as shown on the drawings and as specified herein;
2. Furnish trim attachments and fastenings, specified or otherwise required, for proper and complete installation.
3. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.

B. Related work:

1. Division 1 – General Requirements
2. Division 6 – Rough Carpentry
3. Division 6– Finish Carpentry: Installation of Finish Hardware
4. Division 8 – Steel Doors and Frames
5. Division 8 – Wood Doors
6. Division 8 – Special Doors
7. Division 8 – All Glass Entrances and Storefronts
8. Division 8 – Aluminum Framed Entrances and Storefronts
9. Division 16 – Smoke Detection Systems
10. Division 16 – Security Access Systems

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:

1. Cabinet Hardware.
2. Signs, except as noted.
3. Folding partitions, except cylinders where detailed.
4. Sliding aluminum doors
5. Chain link and wire mesh doors and gates
6. Access doors and panels
7. Overhead and Coiling doors

1.2 REFERENCES

A. National Fire Protection Associations (NFPA):

1. NFPA 101-2009, "Life Safety Code"
2. NFPA 80-1999, "Installation of Fire Doors and Windows"

B. Michigan Building Code -2012

C. American National Standards Institute (ANSI):

1. ANSI A 156 Standards series.
2. ICC/ANSI A117.1-2003 Accessible and Usable Buildings and Facilities

1.3 DEFINITIONS

A. "Finish Hardware": Items required for swinging, sliding and folding doors, except special types of unique and non-matching hardware specified under door and frame Sections of these Specifications.

1.4 SYSTEM DESCRIPTION

A. Design requirements:

1. Review of hardware requirements:

a. Thoroughly review finish hardware schedule, comparing it with the floor plan, door schedule, and door details to verify hardware requirements, quantities, door swings, finishes, and sizes.
b. If an inconsistency or error in the proposed construction documents is suspected, the hardware supplier is to bring it immediately to the attention of the Architect. If the quantity of items is questioned, for bidding purposes, assume the higher quantity is required and price accordingly.
c. Architect's review of Submittals is for design concept only, and does not relieve the Contractor of the responsibility to furnish sufficient material and functions required for a complete and code-worthy installation. Determination of all quantities is the responsibility of the Contractor.

B. Performance requirements:

1. Furnish finish hardware complying with the requirements of laws, codes, ordinances and guidelines of governmental authorities having jurisdiction:

a. NFPA 101, "Life Safety Code", 2009 edition
b. NFPA 80, "Installation of Fire Doors and Windows", 1999 edition
c. Michigan Building Code -2012
d. ICC/ANSI A117.1-2003 Accessible and Usable Buildings and Facilities

1.5 Submittals:

A. Hardware Schedule

1. Submit number of Hardware Schedules as directed in Division 1.
2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
3. Schedule will include the following:

a. Door Index including opening numbers and the assigned Finish Hardware set.
b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	**SPECIFIED**	**SCHEDULED**
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

c. Hardware Locations: Refer to DHI Article 3.1 B.2 Locations.

d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
e. Hardware Description: Quantity, category, product number, fasteners, and finish.
f. Headings that refer to the specified Hardware Set Numbers.
g. Scheduling Sequence shown in Hardware Sets.
h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
i. Electrified Hardware system operation description.
j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
k. Typed Copy.
l. Double-Spacing.
m. 8 1/2 x 11 inch sheets
n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:

1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
2. Submit product data with hardware schedule.

C. Samples:

1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures, may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Key Schedule:

1. Submit detailed schedule indicating clearly how the Owner's final keying instructions have been followed.
2. Submit as a separate schedule.

E. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.6 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.

B. Supplier qualifications:

1. A recognized architectural finish hardware supplier with its' parent company located within 100 miles of the project site.
2. Continuously in business of finish hardware supply for not less than 5 years.

C. Provide the service of a qualified Architectural Hardware Specialist to:

1. Be available for consultation with the Architect at no additional cost to the Owner during progress

of construction, and:

a. Inspect installation of all finish hardware items;
b. Make all minor adjustments required; and
c. Report to the Architect on completeness of the installation.

2. The hardware consultant may be an employee of the supplier.

D. Installer qualifications: Employ a competent hardware installer with at least five (5) years experience installing commercial grade hardware similar to that proposed for the Work.

E. Source limitations: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01620.

B. Product identification:

1. Tag and mark each item separately in manufacturers unopened package, identifying it by product number and architectural opening number, as listed in the approved Finish Hardware Schedule.
2. Include instructions, templates, and fasteners needed for installation.

C. Deliver individually packaged hardware items on a vehicle operated by a direct employee of the Hardware Supplier. Contractor shall immediately, and in the presence of the Hardware Supplier, inventory the contents of the delivery.

D. Hardware supplier: Furnish finish hardware items directly to the factory or mill for factory-installation, where required.

1.8 PROJECT CONDITIONS

A. Provide a secure, well lit, dry storage area for the sole purpose of storing finish hardware. Prohibit access to all jobsite personnel, except those employed by the installing contractor.

1.9 WARRANTY

A. Manufacturer’s warranty:

1. Refer to Division 1 for warranty requirements.

B. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Replace work found to be defective as defined in the General Conditions.

C. Failures due to defective materials or workmanship to include, but not to be limited to:

1. Failures in operation of any operating component;
2. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the products furnished under this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each finish hardware item is indicated in the Finish Hardware Schedule at the end of this Section.

B. Product designations:

1. One or more manufacturers are listed for each hardware type required. Product listed is for basis of design. Only products listed in part 2 product descriptions will be allowed for substitution.

C. ANSI/BHMA designations:

1. Used to describe hardware items, or to define quality or function. Provide products complying with these standards in addition to additional requirements of this Section.

D. Hand of door: Drawings show direction of slide, swing (“hand”) of door leafs.

E. Hardware: Use hardware manufactured to conform to published templates and, generally, prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

2.2 MATERIALS

A. Base metals:

1. Manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially-recognized) quality than that specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated.
2. Do not furnish "optional" materials for those indicated, except as otherwise specified.

B. Fasteners:

1. Furnish Phillips flat-head screws with each hardware item, unless otherwise indicated.
2. Exposed screws: Match finish of hardware (even where noted to be "prepared for paint").
3. Use concealed fasteners for hardware units which are exposed when door is closed, except where no standard units of type specified are available with concealed fasteners.
4. Do not use thru-bolts where bolt head or nut on opposite face would be exposed.
5. Where adequate reinforcement is not feasible, thru-bolting would only be acceptable if through sleeves, or if sex-screw fasteners are used.

C. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.3 MANUFACTURED UNITS, GENERAL

A. Reference standards:

1. Comply with BHMA/ANSI A156 current series for each product type.

B. Hardware finishes:

1. Materials and Finishes Standard: Comply with ANSI A156.18 Finish designations used in

schedules are listed, therein.
2. Provide matching finishes for hardware units at each door, unless otherwise indicated.
3. Match the color and texture of hardware items to manufacturer's standard finish for the latchset, lockset, or push-pull unit.
4. Provide quality of finish, including thickness of plating or coating, composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than that specified or described by referenced standards.

C. Hardware for fire-rated openings:

1. Comply with NFPA 80
2. Tested and listed by Underwriters Laboratory (UL), or Factory Mutual (FM) for type, size and use of door, and complying with requirements of door and door frame label.
3. Provide UL or FM label on door indicating "Fire door to be equipped with fire-exit hardware".
4. Provide UL or FM label on exit device indicating "Fire Exit Hardware".

2.4 PRODUCTS

A. Hinges:

1. Continuous Hinges:
   a. Continuous shall be Pin & Barrel Stainless steel hinges with 600lb rating.
   b. ANSI/BHMA A156.26 -Grade 1.
   c. Fire-rating: "WHI-listed" or "UL-listed" as necessary
   d. Placement of fire label will be on top of the door at cont. hinge locations.
   e. Fasteners: Manufacturer standard; as required by door and frame condition.
   f. Furnish all continuous hinges with FBRG Flange Bearing option.
   g. Undersize doors according to hinge clearance requirements.
   h. Acceptable manufacturer's: Larsen & Shaw, IDC

2. Butt Hinges:

   a. ANSI A156.1 - for commercial quality.
   b. Provide only template-produced units.
   c. All butt hinges to be ball bearing-5 knuckle type Standard or Heavy Weight as specified.
   d. Hinges at exterior doors shall be of non-ferrous material.
   e. Hinges at out-swing corridor doors: Non-removable (NRP)
   f. Size and number of hinges as specified; otherwise according to hinge manufacturer's recommendation for door size and weight.
   g. Acceptable products: PDQ, Bommer, International.

B. Lock Cylinders and Keying:

1. General:

   a. Supplier shall meet with Owner and Architect to finalize keying requirements and obtain final written instructions. Supplier will furnish Combinated cores with owner provided bitting list.

2. Cylinders:

   a. Type: Mortise or rim-type as required by function of locking device.
   b. Provide screw on cams or tail piece as required.
   c. Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
   d. Provide solid machined cylinder rings with tension spring to resist wrenching of cylinder.

Length, finish and size as required.

e. Provide cylinder(s) and core(s) as required by function for each locking device.

3. System:

a. Provide temporary IC brass construction cores for each cylinder provided.
b. Unless otherwise instructed, where “PDQ2” is indicated, provide combinated PDQ GM final cores

4. Keying:

a. Deliver keys and final cores to the hardware installation Contractor for final installation, when directed by the Owner.
b. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
c. Key material: Nickel silver
d. Key quantity:

(1) Three (3) change keys for each lock; Two (2) core keys.
(2) Five (5) master keys for each master system.
(3) Five (5) grandmaster keys for each grandmaster system.

C. Locksets:

1. Cylindrical Locks

a. Comply with ANSI A156.2 –Series 4000, Grade 1 criteria for cylindrical locks
b. Functions Indicated in the hardware sets.
c. Provide appropriate fasteners for lock and strike.
d. Provide strike sized for frame application.
e. Trim: PHL lever-type, SFIC prep, equal to PDQ.
f. Acceptable products: PDQ GT, equal by MBS MB1

D. Exit devices:

1. General:

a. Comply with ANSI A156.3, Grade 1, Types 1, 4, and 28 criteria for products supplied.
b. At fire doors:

(1) Provide UL or FM label on exit device indicating "Fire Exit Hardware", where appropriate.
(2) Mount exit device using sex-bolts on labeled wood doors.

2. a. Type: Flat, push-bar type –comprised completely of stainless steel.
b. Provide functions as specified in sets.
c. Provide dead-locking latch bolts.
d. Function indicated in the hardware sets.
e. Trim: Extra-heavy-duty lever “PHL” type.
f. Acceptable products: PDQ 6000 series, SDCS6000 series / MBS Q1000

E. Door closers:

1. General:

a. ANSI A156.4 - 1986 Grade 1 criteria.
b. All closers shall be the products of one manufacturer.

2. Description:

a. Full rack-and-pinion type with double heat-treated spindle.
b. Cast Iron Body.
c. Hydraulic fluid: Non-gumming and non-freezing.
d. Closer body: Non-handed, multi-size spring power.
e. With three non-critical V valves and hex key adjustment to independently regulate sweep latch speed and backcheck.
f. Provide mounting brackets necessary to clear sound seals and weatherstrip.
g. Enclose in a full, molded cover.
h. Provide drop plates and / or special brackets for proper mounting.
i. Pressure Relief Valves will NOT be accepted on Door Closers.
j. Provide Barrier Free power setting as required by ANSI A117.1

3. Acceptable products:
a. PDQ 7100 series, International 44CI Series, MBS QDC 40

F. Overhead stops:

1. General: ANSI A156.8 - 1982 Grade 1 criteria.
2. Description:

a. Surface-, or concealed-mounted overhead stops where scheduled.
b. Track and arm: High-quality extruded brass or bronze and plated or polished to the finish specified.
c. Provide thru-bolts when used on fire-rated or hollow core wood doors.

3. Acceptable products: International, RPI and Hiawatha

G. Stops:

1. General:

a. ANSI A156.16 - 1989 Grade 1 criteria.
b. Provide stops where scheduled, wall or floor, as opening conditions dictate, utilizing wall stops wherever possible.

2. Description:

a. Wall stops: Cast brass, bronze or stainless steel. Concave wall stop to have stainless steel washer imbedded in rubber stop.
b. Floor stops: Cast Stainless, brass or bronze, and plated as required.
c. Make selection of floor stop height based upon floor conditions and door undercut.
d. Provide magnetic hold-open wall stops where specified.

3. Acceptable products: PDQ, Haiwatha, Soss

H. Kick plates, mop plates and armor plates:

1. General: ANSI A156.16 - 1989 criteria.
2. Description:

a. Minimum .050" thick, B4E Bevel 4 edges.

b. Dimensions:

(1) Width: 1-1/2" less than door width to which they are to be applied.
(2) Kick plate height: 10"
(3) Armor plates: 34" for non-labeled doors, unless scheduled otherwise.

3. Mounting:

a. **Install kick plates and armor plates flush to bottom edge of door.**
b. Notch armor plates for lock or exit device trim or active case.
c. When armor plate is used on doors with touch bar type exit devices, determine height of plate by measuring from bottom of door to 1" below bottom of touch bar, and notch for active case.

4. Acceptable manufacturers: Hiawatha, PDQ and IDC

I. Push / Pull bars & Grips:

1. General:

a. ANSI A156.16 - 1989 Grade 1 criteria.

2. Description:

a. Offset pull bar 1" in diameter x 10” center to center.
b. Straight push bar 1" in diameter x length required by door width.
c. Closet Pull: Pull Diameter: 3/4", CTC: 8" w/ S Style plates.

3. Mounting:

a. Mount push-pull bars back to back with thru-bolts and decorative through bolt fixing at free ends.
b. Mount pull bars with decorative through bolt fixing at free ends.
c. Mount offset pulls so as to avoid conflict with cylinder operation.

4. Acceptable products: PDQ, Hiawatha, FSB

J. Push Plates & Pull Plates:

1. General:

a. ANSI A156.6 Grade 1 criteria.

2. Description:

a. Pull Plate: Pull Diameter: 1", CTC: 8", Plate: 4” x 16” x .050
b. Push Plate 6” x 16” x .050”
c. Base Metal: Solid Stainless Steel

3. Mounting:

a. Mount Pull Plate prior to Push Plate –Pull fasteners shall be concealed under Push Plate.

4. Acceptable Manufacture: PDQ, Hiawatha, FSB

K. Thresholds:

1. General:

a. ANSI A156.21 - 1989, Grade 1 criteria.
b. Comply with A.D.A. requirements, unless otherwise scheduled.

2. Description:

a. Flat profile
b. Installation locations are scheduled.
c. Provide templates for thresholds to related door suppliers to coordinate proper undercut.

3. Acceptable products: Reese, Durable Products, KNCrowder

L. Door Seal and Inside Astragals:

1. General:

a. ANSI A156.21 - 1989, Grade 1 criteria.

2. Description:

a. Flat profile.
b. Dimensions: Appropriate to door opening size.
c. Installation locations are scheduled.
d. Provide templates for thresholds to related door suppliers to coordinate proper undercut.

3. Mounting:

a. Apply related hardware (closer, foot bracket, strike, etc.) on top of hardware compatible type weatherstrip.
b. Do not notch or splice weather strip.
c. Adjust related template hardware locations, as required.

4. Acceptable products: Reese, Durable Products, KNCrowder

M. Sweeps and strips:

1. General:

a. ANSI A156.21 - 1989, Grade 1 criteria.

2. Description:

a. Flat profile.
b. Dimensions: Appropriate to door opening size.
c. Installation locations are scheduled.

3. Acceptable products: Reese, Durable Products, KNCrowder

N. Key Control:

1. Key Cabinet

a. Provide a Complete System; Including all accessories -key gathering envelopes, hook labels,

permanent key tags, temporary key tags, signature receipt forms, visible index and instruction book. Provide with capacity for 150 percent of the number of locks required for the project.

b. Provide complete cross-index system set up by hardware supplier. Place keys on markers and hooks in the cabinet as determined by the final key schedule. Provide hinged panel type cabinet for wall mounting. Provide one each wall mounted key cabinet.
c. Provide Tel Kee RWC-Series with complete system.
d. Supplier shall include the cost of this service in their proposal.

O. Swinging Power Operated Doors:

1. General:
   a. All automatic doors shall comply with ANSI 156.19 and be UL listed.
   a. All automatic doors shall be low energy type.
   b. Furnish all necessary peripherals for each opening for the application as scheduled. Provide Aux. power supply as required for peripherals.
   c. Provide Fire Alarm contacts at all rated openings.
   d. Automatic door equipment must be installed by an AAADM installer. AAADM certification must be supplied to owner upon completion.
   e. Furnish touch actuators as specified.
   f. Acceptable Swinging products: Record 8100 LE

P. Miscellaneous Hardware Equipment and Material:

1. General:

   a. Provide items and types as specified.

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.6 HARDWARE FINISHES

A. General:

1. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible and except as otherwise indicated.
2. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening.
3. In general, match items to the manufacturer's standard finish for the latch and lock set (or push/pull units if no latch/lock sets) for color and texture.
4. Provide finishes matching those established by BHMA or, if none established, match the Architect's sample.
5. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than that specified for the applicable units of hardware by referenced standards.
6. Finish designations used in schedules and elsewhere listed in ANSI A156.18 "Materials and Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

B. Provide the following hardware finishes, unless otherwise scheduled: Dull Chrome, Stainless Steel, and Aluminum color pallet.

C. Base material: Manufacturer's standard high-carbon steel, brass, or bronze.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

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

3.2 COORDINATION

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

3.3 INSTALLATION

A. General:

1. Install each item in its proper location firmly anchored into position, level and plumb, and in accordance with the manufacturer's recommendations.
2. Handing, hardware heights, locations, and degree of opening swing are indicated in the Drawings and Finish Hardware Schedule.
3. Mount finish hardware units:

    a. At recommended heights and locations as shown in approved finish hardware schedule, complying with requirements of the A.D.A., and pertinent provisions of the Building Code.
    b. To function at proper degree of opening of doors as indicated on approved finish hardware schedule.
    c. By manufacturer's template.
    d. Prior to final finishing of the door. Remove hardware to allow finishing of door, and permanently reinstall hardware upon completion of finishing operation.

4. Reinforce, where necessary, the substrate to assure proper attachment.
5. Drill and countersink units which are not factory-prepared for anchorage fasteners.
6. Space fasteners and anchors in accordance with industry standards.

B. Installing closers:

1. Mount closers per manufacturer's template, and secure the Architect's approval of the closer installation.
2. The Contractor will be required to **REPLACE** doors onto which closers are improperly mounted at no additional cost to the Owner. Repair or patching of such doors will not be acceptable.

C. Installing Stops: Install all wall stops into reinforced wall or stud. Projection type wall stops (1298) should be mounted 80" from finish floor, with sloped portion of the stop facing up / flat side down. Install floor stops out of the way foot traffic at a height high enough to accommodate any ramp or uneven floor condition.

D. Installing thresholds at exterior doors: Set in full bed of butyl-rubber, or polyisobutylene mastic sealant.

E. Installing weatherstrip: Install weatherstrip prior to installing closers, OH Stops or panic hardware. Template closers and panic devices from weatherstrip and install all closer / OH Stop shoe brackets and panic device strikes onto the weatherstrip without notching or cutting the weatherstrip.

F. Installing Sweeps: Install all sweeps on exterior side of opening.

3.4 FIELD QUALITY CONTROL

A. Inspection of final hardware installation: The Contractor, hardware suppliers, and Architectural Hardware Consultant (AHC) shall thoroughly check the quality of the installation and the functionality of each unit of finish hardware at all openings in the Work. The Hardware Supplier shall forward a detailed written report of all operational or installation deficiencies to the Architect and Contractor.

3.5 CLEANING AND ADJUSTING

A. Check and adjust each item of hardware and each door upon completion of final installation. Verify proper function, and replace units which cannot be made to operate freely and smoothly, as intended for the application.

B. Clean adjacent surfaces soiled by hardware installation.

3.6 FINISH HARDWARE SCHEDULE

Hardware Set 1 —Panics x Mull + w/ Pulls [Lock / Unlock] +Auto Op & Closer Stops

2	ea.	Continuous Hinge LS300	32D
1	ea.	Rim Panic 6212R (01) (CD)	32D
1	ea.	Rim Panic 6212R (03) (CD)	32D
1	ea	Removable Mullion 9200M (Paint to match Surrounding)	USP
1	ea.	Rim Cylinder I5308 x I5207-1 PDQ2 (03)	26D
2	ea.	Mortise Cylinder I5308 x I5208-1 PDQ2 (03)	26D
1	ea.	Rim Cylinder I5308 x I5207-1 PDQ2 (KM)	26D
2	ea	Pull 658A x A Mount	32D
1	ea.	Door Closer 7101 BC SCS stop x DPPA (push side mount)	AL
1	ea	Record Auto Operator 8100LE	AL
1	ea	Exterior Actuator 4 x 4-3WR	32D
1	ea	Interior Vestibule Actuator 4 x 4-3	32D
1	ea.	Threshold S205A (notch & cope as required)	AL
2	ea.	Sweep 354C –Mount pull side	AL
1	set	Weatherstrip By door and frame manufacturer	AL

Hardware Set 2 –Push Pull Bar Set [Always Unlocked] + Auto Op & Closer Stops

2	ea.	Continuous Hinge LS300	32D
2	sets	Push Pull bar set 658AX1081LBP x A Mount	32D
1	ea	Record Auto Operator 8100LE	AL
1	ea	interior Actuator 4 x 4-3	32D
1	ea.	Door Closer 7101 BC SCS stop x DPPA (push side mount)	AL

Hardware Set 3 –Panic x Classroom Trim [Lock / Unlock] +Closer Stop

3 ea.	Butt Hinge 35STHB 4545 NRP	26D
1 ea	Panic Device 6200RF x 6EW 08 PHL Classroom Trim	32D
1 ea.	Mortise Cylinder I5308 x I5208-1 PDQ2 (08)	26D
1 ea	Door Closer 7101 BC SCS stop x DPPA (push side mount)	AL
Note:	Fire rated seal, as required, by door and frame manufacturer	

Hardware Set 4 –Panics x Classroom Trim + Mullion [Lock / Unlock] +Closer Stop

6 ea.	Butt Hinge 35STHB 4545 NRP	26D
2 ea	Panic Device 6200RF x 6EW 08 PHL Classroom Trim	32D
1 ea	Removable Mullion 9200MF (Paint to match Surrounding)	USP
2 ea.	Mortise Cylinder I5308 x I5208-1 PDQ2 (08)	26D
1 ea.	Rim Cylinder I5308 x I5207-1 PDQ2 (KM)	26D
2 ea	Door Closer 7101 BC SCS stop x DPPA (push side mount)	AL
Note:	Fire rated seal, as required, by door and frame manufacturer	

Hardware Set 5 –Panic + Pull Trim [Lock / Unlock] + Closer Stop

3 ea.	Butt Hinge 35SSHB 4545 NRP	32D
1 ea.	Rim Panic 6201R (03) (CD)	32D
1 ea.	Rim Cylinder I5308 x I5207-1 PDQ2 (03)	26D
1 ea.	Mortise Cylinder I5308 x I5208-1 PDQ2 (03)	26D
1 ea	Pull 658A x A Mount	32D
1 ea.	Door Closer 7101 BC SCS stop (push side mount)	AL
1 ea.	Kickplate 98 10 x 2” LDW	32D
1 ea.	Threshold S205A (notch & cope as required)	AL
1 ea.	Sweep 354C –Mount pull side	AL
1 set	Weatherstrip 855C (mount prior to closer shoe & Strike)	AL

Hardware Set 6 – Flushbolts x Deadbolt + Pulls [Lock / Unlock] + OH Stops

6 ea.	Butt Hinge 35STBB 4545 NRP	26D
1 set	Flush Bolts 93270 x 93270 + 909 Dust Proof Strike	26D
1 ea	Deadbolt KM116IC SF7 -PDQ2	26D
1 ea.	Roller Latch 572 (active door leaf)	26D
1 ea.	Pull H3D (active door leaf)	26D
2 ea.	Overhead Stop OH4903S	32D

Hardware Set 7 –Passage Set [Always Unlocked] + Closer

3 ea.	Butt Hinges 35STBB 4545 NRP	26D
1 ea.	Passage Set GT 126 PHL	26D
1 ea.	Closer 7101 BC PA (push side mount)	AL
1 ea	Wall Stop 102	26D
1 ea.	Kickplate 98 10 x 2” LDW	32D
1 set	Smoke Seal 797B	BLK

Hardware Set 8 –Storeroom lock [Always Locked] + Closer Stop

3	ea.	Butt Hinges 35STBB 4545 NRP	26D
1	ea.	Storeroom Lockset GT 115IC PHL –SF7+PDQ2	26D
1	ea.	Closer 7101 BC SCS (push side mount)	AL
1	ea.	Kickplate 98 10 x 2” LDW	32D
1	set	Smoke Seal 797B	BLK

Hardware Set 9 –Classroom lock [Lock / Unlock] + Closer

3	ea.	Butt Hinges 35STBB 4545 NRP	26D
1	ea.	Classroom Lockset GT 148IC PHL –SF7+PDQ2	26D
1	ea.	Closer 7101 BC PA (push side mount)	AL
1	ea	Wall Stop 102	26D
1	ea.	Kickplate 98 10 x 2” LDW	32D

Hardware Set 10 –Office lock [Lock / Unlock]

3	ea.	Butt Hinges 35STBB 4545 NRP	26D
1	ea.	Office Lockset GT 116IC PHL –SF7+PDQ2	26D
1	ea	Wall Stop 102	26D

Hardware Set 11 –Push & Pull [Always Unlocked] + Closer

3	ea.	Butt Hinge 35STBB 4545 NRP	26D
1	ea	Pull Plate 200F x 535B (mount prior to push plate)	32D
1	ea	Push Plate PP200H (Mount over Pull fasteners)	32D
1	ea	Closer 5301 BC PA (pull side mount)	AL
1	ea	Wall Stop 102	26D
1	ea.	Kickplate 98 10 x 2” LDW	32D

Hardware Set 12- Privacy set [Lock / Unlock] + Closer Stop

3	ea.	Butt Hinge 35STBB 4545 NRP	26D
1	ea.	Privacy set GT176 PHL	26D
1	ea.	Closer 5301 BC SCS (push side mount)	AL
1	ea.	Kickplate 98 10 x 2” LDW	32D

Hardware Set 13 –Storeroom lock [Always Locked] + Closer

3	ea.	Butt Hinges 35STBB 4545 NRP	26D
1	ea.	Storeroom Lockset GT 115IC PHL –SF7+PDQ2	26D
1	ea.	Closer 7101 BC PA (pull side mount)	AL
1	ea	Wall Stop 102	26D
1	ea.	Kickplate 98 10 x 2” LDW	32D

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section included glazing and related components.

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

1. Division 8 Section “Steel Doors and Frames” for glazing requirements in steel doors and frames.

1.3 GLAZING SCHEDULE

A. Typical Glazing:

1. Building Wall Glazing: Gasket each face. Glazing and butt glazing.
2. Interior Fixed glass: Black glazing tape.
3. Interior Glazed Doors: Black glazing tape.

B. Safety glass where required: Meet or exceed applicable current requirements of ANSI Z97.: “Safety Glazing”.

1.4 SUBMITTALS

A. Samples:

1. Each type and thickness of glass; three (3) samples, 12 inches square. Framed assembly, complete with backing and edge for framed mirrors; one (1) unit not less than 12 inches square.
2. Gaskets and Tapes; Three (3) samples, 6 inches long; each type and shape; molded corners for each type of gasket.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Glass:

1. All Glass: Conform to Fed. Spec. DD-G451D, type and thickness as indicted.
2. Sheet Glass: Clear sheet, thickness as indicated on drawings; Type I, Class I Quality q4.
3. Clear Transparent Float and Plate: Type I, Class I, Quality q3:

a. All interior glazed wood or hollow metal doors, transoms, side lights and partitions: 1/4 inch, clear tempered.

4. Low-E Clear:

a. Glass 1/4 inch for all exterior insulated glazing systems: doors, windows, sidelights.
b. Refer to Item 7 below.

5. Insulating Glass: Unless otherwise specified 1 inch thick unit with ½ inch air space composed of 1/4 inch thick clear glass at interior and 1/4 inch thick bronze tinted at exterior pane as specified with low E coating on No. 3 face. Manufacturer's standard ten year warranty type; Viracon, Perilstein, Thompson or Coolidge Glass Co. or approved equal

a. Primary sealant dual polyisobutylene sealant.
b. Provide units with tempered glass where indicated on drawings.
c. Airspace: Dehydrated, contain desiccating agent.
d. Spacers: Spacers for insulating glass shall be black for butt glazed window system.
e. Secondary sealant "Silicone".
f. Muttins shall be installed between glass panes. Refer to Architectural drawings.

6. Tempered Glass conform to Fed. Spec.DD-G-1403B: Type I, Class I or Quality q3.

a. Tolerance: Warpage maximum 1/16 inch per foot but not exceeding 1/8 inch total.
b. Provide at locations where required by Building Code.
c. All Safety Glass required by Code: Tempered unless laminated.
d. Tempering: Horizontal tempering to avoid tong marks for all lights less than 49 inches wide or 120 inches high.

7. High Performance Low Emissivity-Coated Insulating Glass Units: Manufacturer's standard units iwth one pane of glass coated with a durable, neutral-colored, low-emissivity metallic coating, of type and on surface indicated and complying with the following requirements.

a. Interior Pane: Clear float glass, coated on third surface.
b. Kind: As indicated.

B. Schedule of Glass Types:

GL-1: Clear transparent float plate glass.
GL-2: Clear transparent tempered glass
GL-3: 1" solar bronze annealed Low E (1/4" solar bronze float x ½" air space x ¼" clear float).
GL-4: 1" solar bronze tempered Low E (1/4" solar bronze tempered x ½" air space x ¼" clear tempered).
GL-5: Insulated glass provided by pre-manufactured window supplier. Insulated low-E glazing. Refer to Section 085413 of the specifications.

2.2 RELATED MATERIALS

A. Glazing Gaskets: Type and cross section indicated on the drawings, meeting the following requirements:

1. Elastomer Content of Gasket Compound: 100% silicone rubber, black and non-staining.
2. Physical Properties - Glazing Gaskets: Meet performance requirements of ASTM C 542.
3. Detail: Manufacturer's standard detail as indicated and as required to provide specified performance.
4. Type: Closed cell or solid; durometer as required by glazing design.

B. Sealant for Glazing: Meet requirements for materials and workmanship specified under "Joint Sealant" Section of Division 7.

C. Glazing Tape: Tremco #440; Shore A hardness of 10 at installation and not exceeding 20 upon aging.

D. Setting Blocks: neoprene or EPDM 70 to 90 Shore A Hardness as recommended by manufacturer; certified non-staining and compatible with sealant. Use EPDM for units set with silicone glazing sealant.

E. Provide surface mounted glass divider as shown on contract ¾" – 1" wide. Color to match window frames.

PART 3 - EXECUTION

3.1 GLAZING

A. Cutting and Fitting: Cut all glass and fit with the minimum edge clearance and bite on glass recommended by the glass manufacturer and FGMA and within an allowable tolerance of 1/32 inch per 1/8 inch of thickness.

B. Cut all tempered glass at the factory exactly to template.

Setting Blocks: As recommended by glass manufacturer, non-staining, compatible with sealant.

C. Workmanship:

1. Install glass in accordance with recommendations outlined in "Glazing Manual" and "Glazing Sealing Systems Manual" prepared by Flat Glass Marketing Association.
2. Remove and replace units showing visible misalignment, open joints or other irregular appearance at the exposed portion of bead.
3. Glaze doors, frames and window wall units in strict accordance with instructions of manufacturer.

D. Interior Glazing: Dryset with black glazing tape.

E. Glaze all exterior entrance doors, sidelights, transums, window wall frames and similar members as follows:

1. Install glass so that 1/8 inch clear space is maintained between glass and stops on both interior and exterior. Wipe glass edges and stop faces with solvent as recommended by sealant manufacturer. Set glazing gasket and install spacer shims and setting blocks. Maintain 1/4 inch below surface of stop.

3.2 GLASS CLEANING AND POLISHING

A. Upon completion of the work in any area, remove from the premises and legally dispose of all packing crates, broken glass and construction debris resulting from the work.

B. Upon completion thoroughly wash, clean and polish all glass and metal work.

C. Remove and replace all chipped, scratched, broken or otherwise defective glass.

END OF SECTION 088000

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Nonload-bearing steel framing members for gypsum board assemblies.
2. Grid suspension systems for gypsum board ceilings and soffits.

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

1. Division 6 Section "Rough Carpentry" for wood framing and furring.
2. Division 9 Section “Gypsum Veneer Plaster”.
3. Division 7 Section “Firestopping” for firestopping systems and fire-resistance-rated joint sealants.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

D. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:

1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Doors within the assembly be a minimum of 20-minute fire-resistance rated fire doors with positive latching, self-closing listed fire door hardware.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Steel Framing and Furring:

   a. Clark Steel Framing, Inc.
   b. Consolidated Systems, Inc.
   c. Dale Industries, Inc.
   d. Dietrich Industries, Inc.
   e. Marino/Ware (formerly Marino Industries Corp.).
   f. National Gypsum Co.; Gold Bond Building Products Division.
   g. Unimast, Inc.

2. Gypsum Board and Related Products:

   a. Domtar Gypsum.
   b. Georgia-Pacific Corp.

c. National Gypsum Co.; Gold Bond Building Products Division.
d. United States Gypsum Co.

3. Grid Suspension Assemblies:

a. Armstrong World Industries, Inc.
b. Chicago Metallic Corp.
c. USG Interiors, Inc.
d. Worthington Steel Company (formerly National Rolling Mills).

2.2 STEEL FRAMING FOR WALLS AND NON-LOAD BEARING PARTITIONS

A. General: Provide steel framing members complying with the following requirements:

1. Protective Coating: Manufacturer's standard corrosion-resistant coating.

B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- (5-mm-) wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 20 gauge - 0.0329 inch (0.84 mm) unless otherwise indicated.
2. Depth: as indicated on contract drawings.

C. Deflection Track: Manufacturer's standard top runner designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 (ASTM A 653M) or ASTM A 568 (ASTM A 568M). Thickness as indicated for studs, and width to accommodated depth of studs, and of the following configuration:

1. Top runner with 2-1/2-inch- (63.5-mm-) deep flanges that either have V-shaped offsets that compress when pressure is applied from construction above or have slots 1 inch (25.4 mm) o.c. that allow fasteners attached to studs through the slots to accommodate structural movement by slipping.

a. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1) Superior Flex Track System (SFT); Delta Star, Inc.
2) SLP-TRK; Metal-Lite, Inc.

D. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth and minimum thickness of base (uncoated) metal as follows:

1. Thickness: 0.0329 inch (0.84 mm), unless otherwise indicated.
2. Depth: 1-1/2 inch (38.1 mm).

E. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch (0.84 mm), designed for screw attachment to steel studs and steel rigid furring channels used for furring.

F. Z-Furring Members: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, fabricated from steel sheet complying with ASTM A 653 (ASTM A 53M) or ASTM A 568 (ASTM A 568M); with a minimum base metal (uncoated) thickness of 0.0179 inch (0.45 mm), face flange of 1-1/4 inch (31.8 mm), wall-attachment flange of 7/8 inch (22.2 mm), and of depth required to fit insulation thickness indicated.

G. Steel Channel Bridging: Cold-rolled steel, 0.0598-inch (1.5-mm) minimum thickness of base (uncoated) metal and 7/16-inch- (11.1-mm-) wide flanges, 1-1/2 inches (38.1 mm) deep, 475 lb/1000 feet (45 kg/100 m), unless otherwise indicated.

H. Steel Flat Strap and Backing Plate: Steel sheet for blocking and bracing complying with ASTM A 653 (ASTM A 653M) or ASTM A 568 (ASTM A 568M), length and width as indicated, and with a minimum base metal (uncoated) thickness as follows:

1. Thickness: 0.027 inch (0.7 mm) where indicated.

I. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

J. Resilient Channel: Cord-rolled galvanized steel, 1/2" x 2-1/2" punched for screw attachment. Unit length shall be 12'-0".

2.3 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

A. General: Provide components complying with ASTM C 754 for conditions indicated.

B. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.

1. Cast-in-place type designed for attachment to concrete forms.
2. Chemical anchor.
3. Expansion anchor.

C. Wire Ties: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.062 inch (1.6 mm) thick.

D. Wire Hangers: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch (4.1-mm) diameter.

E. Channels: Cold-rolled steel, 0.0598-inch (1.5-mm) minimum thickness of base (uncoated) metal and 7/16-inch- (11.1-mm-) wide flanges, and as follows:

1. Carrying Channels: 1-1/2 inches (38.1 mm) deep, 475 lb/1000 feet (70 kg/100m), unless otherwise indicated.
2. Furring Channels: ¾ inch (19.1 mm) deep, 300 lb/1000 feet (45 kg/100 m), unless otherwise indicated.
3. Finish: Rust-inhibitive paint (interior west areas).

F. Steel Studs for Furring Channels: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- (5-mm-) wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 0.0269 inch (0.45 mm), unless otherwise indicated.
2. Depth: As indicated.
3. Protective Coating: Manufacturer’s standard corrosion-resistant coating.

G. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth of 7/8 inch (22.2 mm), and minimum thickness of base (uncoated) metal as follows:

1. Thickness: 0.0269 inch (0.45 mm), unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant coating.

H. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross-furring members that interlock to form a modular supporting network.

2.4 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).

B. Gypsum Wallboard: ASTM C 36 and as follows:

1. Type: Regular for vertical surfaces, unless otherwise indicated.
2. Type: Type X where required for fire-resistance-rated assemblies.
3. Type: Sag-resistant type for ceiling surfaces.
4. Type: Moisture resistant type for wet areas.
5. Type: blue board for plaster wall and ceiling finish.
6. Edges: Tapered.
7. Thickness: 5/8 inch (15.9 mm) unless otherwise indicated.

2.5 TRIM ACCESSORIES

A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal or plastic, with metal complying with the following requirement:

a. Steel sheet zinc coated by hot-dip process or rolled zinc.

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners, unless otherwise indicated.
b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
d. One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
3. For topping compound, use sandable formulation.

D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

1. Ready-Mixed Formulation: Factory-mixed product.

a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
b. Topping compound formulated for fill (second) and finish (third) coats.
c. All-purpose compound formulated for both taping and topping compounds.

2. Job-Mixed Formulation: Powder product for mixing with water at Project site.

a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
b. Topping compound formulated for fill (second) and finish (third) coats.
c. All-purpose compound formulated for both taping and topping compounds.

2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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 transmission of airborne sound.

C. Available Products: Subject to compliance with requirements, acoustical sealants that may be incorporated in the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. PL Acoustical Sealant; ChemRex, Inc.; Contech Brands.
b. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
c. SHEETROCK Acoustical Sealant; United States Gypsum Co.

2. Acoustical Sealant for Concealed Joints:

a. BA-98; Pecora Corp.
b. Tremco Acoustical Sealant; Tremco, Inc.

2.8 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.

C. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.

D. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.

E. Steel drill screws complying with ASTM C 1002 for the following applications:

1. Fastening gypsum board to steel members less than 0.033 inch (0.84 mm) thick.
2. Fastening gypsum board to wood members.
3. Fastening gypsum board to gypsum board.

F. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

1. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, fire-retardant treated blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

1. Where building structure abuts ceiling perimeter or penetrates ceiling.

2. Where partition framing and wall furring abut structure, except at floor.

    a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.
    b. Install deflection and firestop track top runner at fire-resistance-rated assemblies where indicated.

        1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.

D. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building 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 structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers 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.
3. Secure wire hangers by looping and wire-typing, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Sway-brace suspended steel framing with hangers used for support.

C. Install suspended steel framing components in sizes and at spacings indicated, but not less than that required by the referenced steel framing installation standard.

D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring or grid suspension members are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) as measured both lengthwise on each member and transversely between parallel members.

E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. For STC-rated and fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

D. Terminate partition framing at suspended ceilings where indicated.

E. Install steel studs and furring in sizes and at spacings indicated.

1. Single-Layer Construction: Space studs 24 inches (610 mm) o.c., unless otherwise indicated.

F. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

G. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install 2 studs at each jamb, unless otherwise indicated.
2. Extend jamb studs through suspended ceilings and brace to underside of floor or roof structure above.

H. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.6 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

E. Locate both edge or 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. Avoid joints other than control joints at corners of framed openings where possible.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.

1. Except where 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 open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

J. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

3.7 GYPSUM BOARD APPLICATION METHODS

A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless parallel application is required for fire-resistance-rated assemblies. Use maximum-length panels to minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of board.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

1. Fasten with screws.

3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install cornerbead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
3. Install aluminum trim and other accessories where indicated.

D. Install control joints at locations indicated or install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.

D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 4 for gypsum board surfaces, where wall finish is scheduled to receive vinyl wall covering or a painted finish.

E. Use one of the following joint compound combinations as applicable to the finish levels specified:

F. Use the following joint compound combination as applicable to the finish levels specified:

1. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.
2. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
3. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
4. Embedding and First Coat: Job-mixed, drying-type, taping compound. Fill (Second) Coat: Job-mixed, drying-type, topping compound. Finish (Third) Coat: Job-mixed, drying-type, topping compound.
5. Embedding and First Coat: Job-mixed, drying-type, all-purpose compound. Fill (Second) Coat: Job-mixed, drying-type, all-purpose compound. Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.

6. Embedding and First Coat: Setting-type compound. Fill (Second) Coat: Setting-type compound. Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.

G. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.

H. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.

3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 092116

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Metal edge strips.

B. Related Requirements:

1. Section 071416 "Cold Fluid-Applied Waterproofing" for waterproofing under thickset mortar beds.
2. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Section 092400 "Cement Plastering" for scratch coat for thickset mortar setting-bed installations.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference:

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch lengths.
4. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 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 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America and/or...
2. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers and/or...
3. Installer has installed similar work for past 5 years and can provide proof. Installer is knowledgeable of and adheres to TCNA guideliines.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Waterproof membrane.
2. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise 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.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in swimming pools, on exteriors, or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Porcelain Tile Type PT-1: Porcelain Floor Tile. .

1. Manufacturers: Atlas Concorde USA.
2. Series: Fray
3. Face Size: 23-5/8”x 23-5/8”
4. Face Size Variation: Rectified
5. Thickness: 9 mm
6. Face: Plain with square edges.
7. Dynamic Coefficient of Friction: Not less than 0.42 wet.
8. Tile Color and Pattern: TBD from manufacturer’s full range.
9. Grout Color: TBD

B. Porcelain Tile Type PT-2: Porcelain Floor Tile.

1. Manufacturer: Atlas Concorde USA
2. Series: Fray.
3. Face Size: 11-3/4” x 23-5/8”.
4. Face Size Variation: Nominal
5. Thickness: 9 mm
6. Face: Plain with square edges.
7. Dynamic Coefficient of Friction: Not less than 0.42 wet.
8. Tile Color and Pattern: TBD from manufacturer’s full range.
9. Grout Color: TBD

C. Porcelain Tile Type PT-3: Porcelain Floor Tile – Accent Border

1. Manufacturers: Atlas Concorde USA
2. Series: Fray.
3. Face Size: 1x6 Tatami Mosaic cut to 3 rows or 2x2 Mosaic cut to 2 rows.
4. Face Size Variation: Nominal

5. Thickness: 9 mm
6. Face: Plain with square edges.
7. Dynamic Coefficient of Friction: Not less than 0.42 wet.
8. Tile Color and Pattern: TBD (Warm or Cold Tatami).
9. Grout Color: TBD.

D. Porcelain Tile Type PT-4: Porcelain Floor Tile – Accent

1. Manufacturers: Iris US or Atlas Concorde USA
2. Series: Ecocrete or Get.
3. Face Size: 12x24
4. Face Size Variation: Nominal
5. Thickness: 8 mm or 9 mm.
6. Face: Plain with square edges.
7. Dynamic Coefficient of Friction: Not less than 0.42 wet.
8. Tile Color and Pattern: TBD from manufacturer's full range.
9. Grout Color: TBD

E. Porcelain Tile Type PT-5: Porcelain Floor Tile Base

1. Manufacturers: IRIS US or Atlas Concorde USA.
2. Series: Ecocrete or Get.
3. Face Size: 3x24
4. Face Size Variation: Nominal
5. Thickness: 8.0 mm or 9 mm
6. Face: Plain with bullnose edges.
7. Dynamic Coefficient of Friction: Not less than 0.42 wet.
8. Tile Color, Glaze, and Pattern - Bullnose to be used as wall base, color TBD.
9. Grout Color: TBD

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Limit height of threshold to 1/4 inch or less above adjacent floor surface.

2.5 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. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: Subject to compliance with requirements, provide the following:

a. Laticrete International, Inc.; Hydro Ban, Hydro Barrier.
b. Custom Building Products RedGard

2.6 SETTING MATERIALS

A. Latex Portland Cement Mortar: ANSI A118.4 & ANSI 118.11

1. Manufacturers: Subject to compliance with requirements, provide products by the following] [provide products by one of the following available manufacturers offering products that may be incorporated into the Work include:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

    a. Laticrete International, Inc.: 4XLT
    b. Custom Building Products: Versabond Fortified

3. Provide prepackaged dry mortar mix containing dry redispersible vinyl, acetate or acrylic additive which only water must be added at Project site.

4. Provide prepackaged dry mortar mix combined with (acrylic resin or styrene-butadiene-rubber) liquid latex additive at Project site

5. For wall applications provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI 118.4 & 118.11

2.7 GROUT MATERIALS

A. High-Performance Grout: ANSI 118.7

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Laticrete International, Inc.: Permacolor Select
    b. Custom Building Products,: Prism

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 degrees respectively and certified by manufacturer for intended use.

2.8 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. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.

C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Schluter Systems L.P.
    b. Dural Metal Products

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout. For use as required.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Miracle Sealants ; 511 Impregnator
b. Van Hearron,; Stainguard 5000
c. Summtiville Tiles Inc..; SL-15, Invisible Seal.Sealer.
d. TEC, H. B. Fuller Construction Products Inc.; Grout Guard Plus Penetrating Grout

2. Grout sealers shall comply with requirements of FloorScore certification.

2.9 MIXING MORTARS AND GROUT

1. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

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 bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.

a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. 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 CERAMIC TILE 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. Use 1/3 or less running bonds for tiles over 15” on one edge.

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 tiles 8 by 8 inches (200 by 200 mm) or larger.

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.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Porcelain Tile: 1/8 inch (9.5 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 indicated. 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 at locations indicated on drawings.

K. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate. Use over all cracks on tileable substrates.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 MOVEMENT JOINT INSTALLATION

A. Substrate joints must carry through, full width, to surface of tilework.

B. Install expansion joints in tilework over construction/cold joints or control joints in substrates.

C. Install expansion joints where tilework abuts restraining surfaces (such as perimeter walls, curbs, columns), changes in plane and corners.

D. Joint width and spacing depends on application - follow TCNA **"Handbook for Ceramic, Glass, and Stone Tile Installation"** Detail "EJ-171 Expansion Joints" or consult sealant manufacturer for recommendation based on project parameters.

E. Joint width: ≥ ⅛" (3mm) and ≤ 1" (25mm).

F. Joint width: depth ~2:1 but joint depth must be ≥ ⅛" (3mm) and ≤ ½" (12mm)

G. Layout (field defined by joints): 1:1 length: width is optimum but must be ≤ 2:1. Remove all contaminants and foreign material from joint spaces/surfaces, such as dirt, dust, oil, water, frost, setting/grouting materials, sealers and old sealant/backer.

H. Install appropriate backing material (e.g. closed cell backer rod) based on expansion joint design and as specified in section 07 92 00.

I. Use sealant manufacturer's primer as required by their published literature.

3.8 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.9 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ceilings consisting of acoustical panels.

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Initial Selection: Manufacturer's color charts consisting of actual acoustical panels or sections of acoustical panels, suspension systems, and moldings showing the full range of colors, textures, and patterns available for each type of ceiling assembly indicated.

C. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, 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.

1.6 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.

1.7 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.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Acoustical Panel Ceiling Schedule at the end of Part 3.

2.2 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 Noise Reduction Coefficient: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

C. Panel Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3, including those referencing ASTM E 1264 classifications.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung 15/16" exposed metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied white finish for type of system indicated.

C. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

G. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

H. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

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. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Comply with paint manufacturer's written instructions for applying and baking and for minimum dry film thickness.
4. 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. Armstrong World Industries, Inc.
b. Celotex Corporation (The); Building Products Division; Architectural Ceilings Marketing Dept.
c. Chicago Metallic Corporation.
d. Fry Reglet Corporation.
e. Gordon, Inc.

f. MM Systems, Inc.
g. USG Interiors, Inc.

2.4 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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.

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. PL Acoustical Sealant; Chemrex, Inc., Contech Brands.
b. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
c. SHEETROCK Acoustical Sealant; United States Gypsum Co.

2. Acoustical Sealant for Concealed Joints:

a. BA-98; Pecora Corp.
b. Tremco Acoustical Sealant; Tremco, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and 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 other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

B. 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

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

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. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. 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.
5. 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; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. Install panels with pattern running in one direction parallel to long axis of space.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of

suspension system runners and moldings.

3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. Paint cut panel edges 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.

3.5 ACOUSTICAL PANEL CEILING SCHEDULE

A. Mineral Base Acoustical Panels for Acoustical Panel Ceiling APC-#: Where this designation is indicated, provide acoustical panels complying with the following:

1. APC-1 - 24" x 24" x 3/4":

a. Armstrong - Cirrus - Tegular - 534 or
b. USG - Eclipse - Clima Plus - 76775

1) NRC: .70
2) CAC: 38
3) Suspension System: 15/16" exposed grid
4) ASTM E/264 Classification: Type III, Form 1, Pattern E1
5) Surface Burning Characteristics: Class A.

END OF SECTION 095113

SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Resilient wall base.
2. Resilient flooring accessories.

B. Related Sections include the following:

1. Division 9 Section "Resilient Floor Tile."

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.

C. Samples for Verification: In manufacturer's standard sizes, but not less than 12 inches (300 mm) long, of each product color and pattern specified.

D. 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 an 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.

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 (10 and 32 deg C).

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 than 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 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each different type, color, pattern, and size of resilient product installed.
2. Deliver extra materials to Owner.

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, those indicated in the Resilient Wall Base and Accessory Schedule at the end of Part 3.

2.2 RESILIENT WALL BASE

A. Rubber Wall Base: Products complying with FS SS-W-40, Type I and with requirements specified in the Resilient Wall Base and Accessory Schedule.

2.3 RESILIENT ACCESSORIES

A. Rubber Accessories: Products complying with requirements specified in the Resilient Wall Base and Accessory Schedule.

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 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, pilasters, casework and cabinets in toe spaces, 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 material.
5. Install premolded outside and inside corners before installing straight pieces.

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. Install transition strips

between flooring materials of difference thicknesses. Place transition strips on center line of door between two rooms with different flooring materials. Refer to drawings for transition strip types.

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.

1. Before cleaning, strip protective floor polish that was applied to vinyl products on floors and stairs after completing installation only if required to restore polish finish and if recommended by resilient product manufacturer.
2. After cleaning, reapply polish on vinyl products on floors and stairs to restore protective floor finish according to resilient product manufacturer's written recommendations. Coordinate with Owner's maintenance program.

3.5 RESILIENT WALL BASE AND ACCESSORY SCHEDULE

A. Rubber Wall Base RB: 4" high preformed coved rubber wall base as manufactured by Johnsonite or equal.

1. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for rubber wall base complying with requirements indicated.
2. Style: Cove with top-set toe.
3. Minimum Thickness: 1/8 inch (3.2 mm).
4. Height: 4 inches (101.6 mm).
5. Lengths: Coils in lengths standard with manufacturer, but not less than 96 feet (29.26 m).
6. Outside Corners: Premolded.
7. Inside Corners: Premolded.
8. Ends: Premolded.
9. Surface: Smooth.

B. Transition Accessories: As manufactured by Johnsonite or equal.

1. Resilient accessories appropriate for the various conditions detailed on drawings, function of thicknesses of flooring materials selected.

END OF SECTION 096513

SECTION 096519 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile.

B. Related Sections:

1. Division 9 Section "Resilient Wall Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.

C. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

D. Samples for Initial Selection: For each type of floor tile indicated.

E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

F. Qualification Data: For qualified Installer.

G. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE - VCT

A. 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.; Imperial Texture.
b. Mannington; Essentials.
c. Tarkett, Inc.; Expressions.

B. Tile Standard: ASTM F 1066, Class 1, solid-color tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm).

F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

a. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1) VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
2) Rubber Floor Adhesives: Not more than 60 g/L. The adhesives shall be of type recommended by rubber flooring manufacturer.

C. Floor Polish for VCT: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings 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.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate acceptable to flooring manufacturer.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096800 - CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Tufted carpet.

B. Related Sections include the following:

1. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base and accessories installed with carpet.

1.3 SUBMITTALS

A. Product Data: For the following, including installation recommendations:

1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of installation.
6. Pattern type, repeat size, location, direction, and starting point.
7. Pile direction.
8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- (300-mm-) square Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
3. Carpet Seam: 6-inch (150-mm) Sample.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

F. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to carpet installation including, but not limited to, the following:

1. Review delivery, storage, and handling procedures.
2. Review ambient conditions and ventilation procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, static protection, zippering, and delamination.
3. Warranty Period: Lifetime from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 TUFTED CARPET - CA

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Cambridge: Portfolio

a. Color: As selected by Architect from manufacturer's full range.

C. Fiber Content: 100 percent nylon 6

D. Pile Characteristic: Patterned textured loop pile.

E. Density: 6000 - 7000 oz./cu. yd.

F. Pile Thickness: .151 in (3.83 mm) for finished carpet per ASTM D 6859.

G. Stitches: 13 stitches per inch

H. Gage: 1/10 in. (39.4 col/10 cm)

I. Face Weight: 26 oz/sq. yd (881 g/m2)

J. Primary Backing: Woven polypropylene.

K. Secondary Backing: iLOC ES

L. Backing System: iLoc ES

M. Width: 12 feet (3.7 m).

N. Applied Soil-Resistance Treatment: Manufacturer's standard material.

O. Antimicrobial Treatment: Manufacturer's standard material.

P. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
2. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
3. Tuft Bind: Not less than 5 lbf (22 N) per ASTM D 1335.
4. Delamination: Not less than 5 lbf/in per ASTM D 3936.
5. Resistance to Insects: Comply with AATCC 24.
6. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
7. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) per AATCC 16, Option E.
8. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
9. Electrostatic Propensity: Less than 2 kV per AATCC 134.
10. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
2. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet against 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 carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096800

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron work, and primed metal surfaces including mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork and casework.
b. Acoustical wall panels.
c. Metal toilet enclosures.
d. Metal lockers.
e. Unit kitchens.
f. Elevator entrance doors and frames.
g. Elevator equipment.
h. Finished mechanical and electrical equipment.
i. Light fixtures.
j. Distribution cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Pipe spaces.
e. Duct shafts.
f. Elevator shafts.

3. Finished metal surfaces include the following:

    a. Anodized aluminum.
    b. Stainless steel.
    c. Chromium plate.
    d. Copper.
    e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

    a. Valve and damper operators.
    b. Linkages.
    c. Sensing devices.
    d. Motor and fan shafts.

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 2 Section "Hot-Mix Asphalt Paving" for traffic-marking paint.
2. Division 2 Section "Portland Cement Concrete Paving" for traffic-marking paint.
3. Division 5 Section "Structural Steel" for shop priming structural steel.
4. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
5. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
6. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
7. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board and corner guard installations.
8. Divisions 15 and 16: Painting of mechanical and electrical work is specified in Divisions 15 and 16, respectively.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and

cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
3. Submit Samples on the following substrates for the Architect's review of color and texture only:

    a. Concrete Masonry: Provide two 4-by-8-inch (100-by-200-mm) samples of masonry, with mortar joint in the center, for each finish and color.
    b. Ferrous Metal: Provide two 4-inch- (100-mm-) square samples of flat metal and two 8-inch- (200-mm-) long samples of solid metal for each color and finish.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1. Final approval of colors will be from job-applied samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Furnish the Owner with extra paint materials in the quantities indicated below:

a. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

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 the paint schedules.

B. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

C. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Devoe & Raynolds Co. (Devoe).
2. Fuller-O'Brien Paints (Fuller).
3. Glidden Co. (The) (Glidden).

4. Benjamin Moore & Co. (Moore).
5. PPG Industries, Inc. (PPG).
6. Pratt & Lambert, Inc. (P & L).
7. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. Colors: Provide color selections made by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

    a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
    c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
    c. When transparent finish is required, backprime with spar varnish.
    d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
    e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

    a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms, mechanical and electrical equipment, and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
2. Heat exchangers.
3. Tanks.
4. Ductwork.
5. Insulation.
6. Motors and mechanical equipment.
7. Accessory items.
8. Roof top penetrators to match color of shingles.

G. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:

a. Quantitative material analysis.
b. Abrasion resistance.
c. Apparent reflectivity.
d. Flexibility.

e. Washability.
f. Absorption.
g. Accelerated weathering.
h. Dry opacity.
i. Accelerated yellowness.
j. Recoating.
k. Skinning.
l. Color retention.
m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

A. Concrete, Stucco, and Masonry (Other than Concrete Masonry Units): Provide the following finish systems over exterior concrete, stucco, and brick masonry surfaces:

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).

1) Devoe: 1502 Wonder-Shield Exterior Latex House Paint Primer.
2) Fuller: 220-17 Acrylic Concrete and Masonry Primer Sealer.
3) Glidden: Primer not required over this substrate.
4) Moore: Moore's Latex Exterior Primer #102.
5) PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.

6) P & L: Z/F 1001 Suprime "1" Multi-Purpose 100 Percent Acrylic Primer.

b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).

1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
4) Moore: MoorGlo Latex House & Trim Paint #096.
5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
6) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

c. Concrete Masonry Units: Provide the following finish systems over exterior concrete masonry units:

2. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a block filler and a primer.

a. Block Filler: High-performance, latex block filler applied at spreading rate recommended by the manufacturer to achieve a total dry mill thickness of not less than 4.0 mils (0.102 mm).

1) Devoe: 52902 Bloxfil 200 Interior/Exterior Latex Block Filler.
2) Fuller: 280-00 Interior/Exterior Latex Block Filler.
3) Glidden: 5317 Ultra-Hide Block Filler Latex Interior-Exterior.
4) Moore: Moorcraft Interior & Exterior Block Filler #173.
5) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
6) P & L: Z/F 98 Pro-Hide Plus Block Filler.

b. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).

1) Devoe: Primer not required over block filler.
2) Fuller: Primer not required over block filler.
3) Glidden: Primer not required over block filler.
4) Moore: Primer not required over block filler.
5) PPG: Primer not required over block filler.
6) P & L: Z/F 1001 Suprime "1" Multi-Purpose 100 Percent Acrylic Primer.

c. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).

1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
4) Moore: MoorGlo Latex House & Trim Paint #096.
5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
6) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

   a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

      1) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
      2) Fuller: 621-04 Blox-Rust Alkyd Metal Primer.
      3) Glidden: 5205 Glid-Guard Tank & Structural Primer, Red.
      4) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
      5) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
      6) P & L: S 4551 Tech-Gard High Performance Rust-Inhibitor Primer.
      7) S-W: Kem Kromik Metal Primer B50N2/B50W1.

   b. First and Second Coats: Full-gloss, exterior, alkyd enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 3.0 mils (0.076 mm).

      1) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
      2) Fuller: 312-XX Heavy-Duty Industrial Maintenance Enamel.
      3) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
      4) Moore: Impervo Enamel #133.
      5) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.
      6) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
      7) S-W: Industrial Enamel B-54 Series.

D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a galvanized metal primer.

   a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

      1. Devoe: 8502/8520 Mirrolac-WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
      2) Fuller: 621-05 Blox-Rust Latex Metal Primer.
      3) Glidden: 5205 Glid-Guard Tank & Structural Primer, Red.
      4) Moore: IronClad Galvanized Metal Latex Primer #155.
      5) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
      6) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex etal Primer.

   b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

      1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
      2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
      3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
      4) Moore: MoorGlo Latex House & Trim Paint #096.
      5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
      6) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

E. Aluminum: Provide the following finish systems over exterior aluminum surfaces:

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Rust-inhibitive, acrylic- or alkyd-based, metal primer, as recommended by the manufacturer for use over aluminum, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

1) Devoe: 8502/8520 Mirrolac-WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
2) Fuller: 621-05 Blox-Rust Latex Metal Primer.
3) Glidden: 6950 Lifemaster Pro Direct-to-Metal Acrylic Coating.
4) Moore: Primer not required.
5) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
6) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.

b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
4) Moore: MoorGlo Latex House & Trim Paint #096.
5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
6) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

3.8 INTERIOR PAINT SCHEDULE

A. Concrete and Masonry (Other than Concrete Masonry Units): Provide the following paint systems over interior concrete and brick masonry surfaces:

1. Semigloss, Alkyd-Enamel Finish: 2 finish coats over a primer.

a. Primer: Alkali-resistant, alkyd- or latex-based, interior primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.0 mil (0.025 mm).

1) Devoe: 51701 Wonder-Prime Interior All-Purpose Latex Primer Sealer & Vapor Barrier.
2) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
3) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
4) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
5) PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.
6) P & L: Z/F 1001 Suprime "1" 100 Percent Acrylic Multi-Purpose Primer.
7) S-W: ProMar 200 Latex Wall Primer B28W200.

b. First and Second Coats: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

1) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Fuller: 206-XX Interior Alkyd Semi-Gloss Enamel.
3) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.
4) Moore: Moore's Alkyd Dulamel #207.
5) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
6) P & L: S/D 5700 Cellu-Tone Alkyd Satin Enamel.
7) S-W: Classic 99 Interior Alkyd Semi-Gloss Enamel A-40 Series.

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

1) Devoe: 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer.
2) Fuller: 220-20 Pro-Tech Interior Latex Wall Primer and Sealer.
3) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
4) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
5) PPG: 17-10 Quick-Dry Interior Latex Primer-Sealer.
6) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mills (0.07 mm).

1) Devoe: 34XX Wonder-Tones Interior Latex Eggshell Enamel.
2) Fuller: 212-XX AA Enamel Acrylic Latex Eggshell Enamel.
3) Glidden: 4100 Series Spred Ultra Eggshell Latex Wall & Trim Paint.
4) Moore: Moore's Regal AquaVelvet #319.
5) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
6) P & L: Z/F 4000 Series Accolade Interior Velvet.

C. Woodwork and Hardboard: Provide the following paint finish systems over new, interior wood surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over primer.

a. Primer: Alkyd or acrylic-latex-based, interior wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mills (0.036 mm).

1) Devoe: 51701 Wonder-Prime All-Purpose Latex Primer Sealer & Vapor Barrier.
2) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
3) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
4) Moore: Moore's Alkyd Enamel Underbody #217.
5) PPG: 17-255 Quick-Drying Enamel Undercoater.
6) P & L: Z/F 1001 Suprime “1” 100 Percent Acrylic Multi-Purpose Primer.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

1) Devoe: 35XX Wonder-Tones Interior Latex Eggshell Enamel.
2) Fuller: 212-XX AA Enamel Acrylic Latex Eggshell Enamel.
3) Glidden: 4100 Series Spred Ultra Eggshell Latex Wall & Trim Paint
4) Moore: Moore's Regal AquaVelvet #319.
5) PPG: 89 Line Manor Hall Interior Eggshell Latex Wall and Trim Enamel.
6) P & L: Z/F 4000 Series Accolade Interior Velvet.

D. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

1) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
2) Fuller: 621-04 Blox-Rust Alkyd Metal Primer.
3) Glidden: 5207 Glid-Guard Tank & Structural Primer, White.
4) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
5) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
6) P & L: S 4551 Tech-Gard High Performance Rust Inhibitor Primer.
7) S-W: Kem Kromik Metal Primer B50N2/B50W1.

b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

1) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
3) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.
4) Moore: Moore's Alkyd Enamel Underbody #217.
5) PPG: 6-6 Speedhide Interior Quick-Drying Enamel Undercoater.
6) P & L: S/D 1011 Suprime "11" Interior Alkyd Wood Primer.
7) S-W: ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200.

c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).

1) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Fuller: 110-XX Fullerglo Alkyd Semi-Gloss Enamel.
3) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.
4) Moore: Satin Impervo #235.
5) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
6) P & L: S/D 5700 Cellu-Tone Alkyd Satin Enamel.
7) S-W: Classic 99 Interior/Exterior Semi-Gloss Alkyd Enamel A-40 Series.

E. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Semigloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the

manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

1) Devoe: 13201 Mirrolac Galvanized Metal Primer.
2) Fuller: 621-05 Blox-Rust Latex Metal Primer.
3) Glidden: 5207 Glid-Guard Tank & Structural Primer, White.
4) Moore: IronClad Galvanized Metal Latex Primer #155.
5) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
6) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
7) S-W: Galvite Paint B50W3.

b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

1) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
3) Glidden: UH 8400 Series Spred Ultra Traditional Alkyd Semi-Gloss Enamel.
4) Moore: Moore's Alkyd Enamel Underbody #217.
5) PPG: 6-6 Speedhide Interior Quick-Drying Enamel Undercoater.
6) P & L: S/D 1011 Suprime "11" Interior Alkyd Wood Primer.
7) S-W: ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200.

c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).

1) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Fuller: 110-XX Fullerglo Alkyd Semi-Gloss Enamel.
3) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.
4) Moore: Satin Impervo #235.
5) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
6) P & L: S/D 5700 Cellu-Tone Alkyd Satin Enamel.
7) S-W: Classic 99 Interior Alkyd Semi-Gloss Enamel A-40 Series.

2. Full-Gloss, Acrylic-Enamel Finish: 2 coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

1) Devoe: 13201 Mirrolac Galvanized Metal Primer.
2) Fuller: 621-05 Blox-Rust Latex Metal Primer.
3) Glidden: 5207 Glid-Guard Tank & Structural Primer, White.
4) Moore: IronClad Galvanized Metal Latex Primer #155.
5) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
6) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
7) S-W: Galvite Paint B50W3.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).

1) Devoe: 84XX Mirrolac-WB Interior-Exterior Waterborne High Gloss Enamel.
2) Fuller: 213-XX AA Enamel Interior Acrylic Latex High-Gloss Enamel.
3) Glidden: 6900 Series Lifemaster Pro Hi-Performance Acrylic Coating.
4) Moore: Impervex Enamel #309.
5) PPG: 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel.
6) P & L: Z/F 4400 Series Accolade Interior High Gloss.
7) S-W: ProMar 200 Interior Latex Gloss Enamel B21W201.

END OF SECTION 099100

SECTION 101200 - BULLETIN BOARDS AND DISPLAY CASES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Illuminated display cases.

B. Related Sections include the following:

1. Division 6 Section "Finish Carpentry".
2. Division 16 Sections for wiring and other electrical work associated with illuminated display cases.

1.3 DEFINITIONS

A. Display Case: Glazed cabinet with adjustable shelves.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for bulletin boards and display cases.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Show location of tack assembly seams and joints.
3. Include sections of typical trim members.
4. Wiring Diagrams: Power, signal, and control wiring for illuminated units.

C. Samples for Initial Selection: For units with factory-applied color finishes as follows:

1. Actual sections of tack assembly.
2. Fabric swatches of vinyl and polyester fabric-faced tack assemblies.
3. Section of header panel for color selection.

D. Samples for Verification: For each type of product indicated as follows:

1. Tack Assembly: Not less than 8-1/2 by 11 inches (215 by 280 mm), mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch- (152-mm-) long sections of each trim profile including corner section.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of vinyl and polyester fabrics.

G. Maintenance Data: For tack assemblies to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each type of product through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of bulletin boards and display cases and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

E. 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.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify recessed 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 products without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 DISPLAY CASE

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:

C. Basis-of-Design Product: The design for display cases is based on Waddell Furniture, recessed trophy case 48"H x 72" W x 16" D (Claridge Products Model 1370 or approved equal) with medium bronze finish. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A-1 Visual Systems.
2. AARCO Products, Inc.
3. ADP/Lemco, Inc.
4. Best-Rite Manufacturing.
5. Claridge Products & Equipment, Inc.
6. Ghent Manufacturing Inc.
7. Nelson-Harkins Industries.
8. Poblocki & Sons.
9. PolyVision Corporation.
10. Tablet & Ticket Co. (The).

D. Recessed, Plywood-Framed Cabinet: Factory-fabricated cabinet, with top, bottom, and sides fabricated from hardwood veneer plywood; with tack assembly on back inside surface, glazed doors at front.

1. Veneer Species: Provide samples for Architect's approval.
2. Aluminum Finish: Clear anodic.

a. Color: Medium bronze.

B. Glazed Hinged Doors: 6-mm-thick tempered glass set in frame matching cabinet material and finish. Equip each door with full-height continuous hinge and cylinder lock with two keys.

C. Shelves: 6-mm-thick tempered glass; supported on adjustable shelf standards and supports.

1. Number of Shelves: Three.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets. Provide standards full height of display case.

E. Tack Surface: Vinyl-fabric-faced tack assembly.

1. Color: As selected by Architect from full range of industry colors.

F. Illumination System: Concealed top-lighting system consisting of fluorescent-strip fixtures. Include lamps and internal wiring with single concealed electrical connection to building system. Coordinate electrical characteristics with power supply provided.

1. Ballasts: Low-temperature, high-power-factor, low-energy, fluorescent lamp ballasts that comply with CBMA standards and carry its label.

2.2 FABRICATION

A. Fabricate bulletin boards and display cases to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing to produce flat surfaces, free of oil canning, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

D. Fabricate exterior units with vents to permit evaporation of moisture trapped inside.

E. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.3 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

E. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

F. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

G. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.

H. Powder-Coat Finish: Apply manufacturer's standard baked finish, complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

2.4 EXTERIOR BULLETIN BOARD

A. Basis of Design: Claridge Products Contemporary Series Bulletin Board Cabinet model 2041. Three feet wide x four feet high weather resistant surface mounted dark bronze aluminum finished bulletin board with 3/16” tempered glass and flat key tumbler lock. Continuous piano hinge and tackable fabric backing. Alternative products/manufacturers to be approved by the Architect.

2.5 INTERIOR BULLETIN BOARD

A. Basis of Design: Claridge Products Contemporary Series Bulletin Board Cabinet. Four feet wide x four feet high surface mounted dark bronze aluminum finished bulletin board with 3/16” tempered glass

and flat key tumbler lock. Continuous piano hinge and tackable fabric backing. Alternative products/manufacturers to be approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for electrical power system to verify actual locations of connections before installation of illuminated units.

C. Examine walls and partitions for proper backing for bulletin boards and display cases.

D. Examine walls and partitions for suitable framing depth where recessed units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for display cases as required by type and size of unit.

3.3 INSTALLATION

A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Recessed Display Cases: Attach units to wall framing with fasteners at not more 16 inches o.c. Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches o.c.

C. Surface-Mounted Display Cases: Attach units to wall surfaces with concealed clips, hangers, or grounds fastened at not more than 16 inches o.c. Secure both top and bottom of display cases to walls.

3.4 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 101200

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Panel signs.
2. Refer to Cash Allowances, Section 012113 for interior and exterior cash allowance.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Acrylic sheet.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
2. Panel Signs: Not less than 12 inches (305 mm) square including border.
3. Accessories: Manufacturer's full-size unit.

E. Sign Schedule: Use same designations indicated on Drawings.

F. Qualification Data: For Installer and fabricator.

G. Maintenance Data: For signs to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. 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.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

1.8.A.1.1 Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.2 PANEL SIGNS

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. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:

1. Acrylic Sheet: 0.080 inch (2.03 mm) thick.
2. Edge Condition: Square cut.

3. Corner Condition: Rounded to radius indicated.
4. Mounting: Framed or side clips.

    a. Wall mounted with two-face tape.
    b. Manufacturer's standard anchors for substrates encountered.

5. Color: As selected by Architect from manufacturer's full range.
6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

C. Panel Sign Frames:

1. PVC Frames: Extruded, high-impact PVC plastic.

    a. Color: As selected by Architect from manufacturer's full range.
    b. Depth: Manufacturer’s standard.
    c. Profile: Square.
    d. Corner Condition: Rounded to radius indicated.
    e. Mounting: As indicated.

        1) Manufacturer's standard anchors for substrates encountered.

D. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of slide-in inserts.

1. Furnish insert material and software for creating text and symbols for computers for Owner production of paper inserts.

E. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

F. Subsurface Engraved Acrylic Sheet: Reverse-engrave back face of clear acrylic sheet. Fill resulting copy with enamel. Apply opaque background color coating over enamel-filled copy.

G. Panel Sign Schedule: See attached Schedule.

2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.5 FINISHES, GENERAL

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

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 work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.

3. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Fixed, aluminum louvers and vents.

B. Related Sections include the following:

1. Division 15 Section “Air Outlets and Inlets” for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section, unless otherwise defined in this Section or in referenced standards.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward or outward.

1.5 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.

B. Welding Standards: As follows:

1. Comply with AWS D1.2, "Structural Welding Code--Aluminum."
2. Comply with AWS D1.3, "Structural Welding Code--Sheet Steel."
3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

D. UL and NEMA Compliance: Provide motors and related components for motor-operated adjustable louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

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. Airline Products Co.
2. Airolite Co.
3. All-Lite Louver Co.
4. American Warming and Ventilating, Inc.
5. Arrow United Industries.
6. Cesco Products.
7. Construction Specialties, Inc.
8. Dowco Products Group.
9. Greenheck Fan Corporation.

10. Hart & Cooley, Inc.; Reliable Metal Products Division.
11. Industrial Louvers, Inc.
12. NCA Manufacturing, Inc.
13. Riesner Vent Brick Corp.
14. Ruskin Manufacturing; Tomkins Industries, Inc.
15. Sunvent Industries; Sylro Sales Corp.
16. Willard Shutter Company, Inc.

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Louver Schedule at the end of Part 3.

D. Products: Basis of design shall be Weather Blade louvers as manufactured by Airline Louvers or approved equal.

2.2 MATERIALS

A. Anodized Aluminum (Dark Bronze).

B. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

C. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1. Continuous Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates and without interrupting blade-spacing pattern.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.

F. Join frame members to one another and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view; unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Louvers & vents shall be anodized aluminum - dark bronze (match window units).

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

3.3 ADJUSTING, CLEANING, AND PROTECTING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Protect louvers and vents from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Substantial Completion.

E. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

a. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 102000

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes toilet compartments and screens as follows:

1. Type: Powder coated baked enamel.
2. Compartment Style: Floor Mounted/Overhead Braced.
3. Screen Style: Wall hung.

B. Related Sections include the following:
1. Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, and similar accessories.

1.3 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

D. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch-(150-mm-) square Samples of same thickness and material indicated for Work.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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. Accurate Partitions Corporation.
2. All American Metal Corp.
3. Ampco Products, Inc.
4. Bobrick Washroom Equipment, Inc.
5. Capitol Partitions, Inc.
6. Commercial and Architectural Products, Inc.; Marlite.
7. Compression Polymers Group; Comtec Industries.
8. Crane Plumbing; Sanymetal.
9. General Partitions Mfg. Corp.
10. Global Steel Products Corp.
11. Hadrian Inc.
12. Knickerbocker Partition Corporation.
13. Lambaton/Universal.
14. MASCO; Flush-Metal Partition Corp.
15. Metpar Corp.
16. Mills Company (The).
17. Partition Systems, Inc.; Columbia Partitions.
18. Santana Products, Inc.
19. Tex-Lam Manufacturing, Inc.
20. Turan Partition Corporation.
21. Weis/Robart Partitions, Inc.
22. Young Sales Corp.; DesignRite.

2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Powder coated baked enamel with finished thickness of doors and panels at 1" and pilasters at 1-1/4". Panels, doors and pilasters shall be insulated with vertical honeycomb filler core cemented under pressure to electrogalvanized-bonderized steel sheets not less than 20 ga. for panels and pilasters, 22 ga. for doors.

C. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

1. For solid-plastic, polymer-resin pilasters, in lieu of stainless-steel pilaster shoes and sleeves, manufacturer's standard plastic pilaster shoes and sleeves may be provided.

D. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of the following material:

1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

E. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:

1. Material: Clear-anodized aluminum.
2. Material: Solid plastic.

F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:

1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.
2. Material: Stainless steel.

G. Overhead Bracing: Manufacturer’s standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer’s standard finish.

H. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip in manufacturer's standard finish.

I. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Metal-Faced Toilet Compartments and Screens: Pressure laminate seamless face sheets to core material and provide continuous, interlocking molding strip or lapped and formed edges. Seal corners by welding or clips. Grind exposed welds smooth.

C. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.

D. Doors: Unless otherwise indicated, provide 24-inch-(610-mm-) wide in-swinging doors for standard toilet compartments and 36– (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than ½ inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

B. Floor Mounted/Overhead Braced Compartments: Secure pilasters to supporting floor and walls and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.

C. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 102113

SECTION 102814 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes toilet and bath accessory items as scheduled.

B. Toilet compartments and related accessories are specified in Division 10.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specifications Sections.

B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.

C. Samples of each toilet accessory item to verify design, operation, and finish requirements. Acceptable full-size samples will be returned and may be used in the Work.

D. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.

E. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.

F. Maintenance instructions including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.5 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.6 WARRANTY

A. Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.

B. Warranty Period: 15 years from date of Substantial Completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering toilet accessories that may be incorporated in the Work include, but are not limited to, the following:

1. A & J Washroom Accessories.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. McKinney/Parker.

2.2 MATERIALS, GENERAL

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034 inch (0.9 mm) minimum thickness.

B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16 (ASTM B 16M); Castings, ASTM B 30.

C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366 (ASTM A 366M), 0.04 inch (1.0 mm) minimum. Surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 527 G60 (ASTM A 527M Z180).

E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

F. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.

G. Mirror Glass: Nominal 6.0 mm thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro- plated copper coating, and protective organic coating.

H. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.3 ACCESSORIES: BY IDENTIFICATION NUMBERS AS INDICATED ON THE FOLLOWING TOILET ACCESSORY SCHEDULE

A. Referenced Manufacturer: Bobrick Washroom Equipment, Inc. U.N.O.

B. Refer to drawings for number of accessories required and locations.

1. TA-1 18” long grab bar (B-6806 x 18”)
2. TA-2 36" long grab bar (B-6806 x 36")
3. TA-3 42" long grab bar (B-6806 x 42")
4. TA-4 Toilet Tissue Dispenser (B-2740)
5. TA-5 Counter Mounted Soap Dispenser (B-8221)
6. TA-6 Circular Waste Chute (B-529)
7. TA-7 Surface Mtd. Paper Towel Dispenser (B-4262)
8. TA-8 Double Robe Hook (B-7672)
9. TA-9 Surface Mounted Sanitary Napkin Disposal (B-270)

2.4 FABRICATION

A. General:

1. No names or labels are permitted on exposed faces of units.
2. On either interior surface not exposed to view or on back surface, provide identification of each item by either a printed, waterproof label or a stamped nameplate indicating manufacturer’s name and product model number.

B. Surface-Mounted Accessories:

1. Fabricate units with tight seams and joints, exposed edges rolled.
2. Hand doors or access panels with continuous stainless steel piano hinge.
3. Provide concealed anchorage wherever possible.
4. Contractor shall install blocking as required.

C. Recessed Accessories:

1. Fabricate units of welded construction, without mitered corners.
2. Hand doors or access panels with full-length stainless steel piano hinge.
3. Provide anchorage which is fully concealed when unit is closed.
4. Contractor shall install blocking as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units in accordance with manufacturer’s instructions, using fasteners appropriate to substrate and recommended by manufacturer of unit.

B. Install units plumb and level, firmly anchored in locations and at height indicated.

C. Provide tamper-proof fastenings.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for proper operation and verify that mechanisms function smoothly.

B. Replace damaged or defective items.

C. Clean and polish exposed surfaces after removing temporary labels and protective coatings.

END OF SECTION 102814

SECTION 104416 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Fire extinguishers.
2. Fire extinguisher mounting brackets.

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

1. Division 15 Section "Fire Protection" for fire protection systems.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain extinguishers and mounting brackets from one source from a single manufacturer.

B. UL-Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. J.L. Industries.
2. Larsen's Manufacturing Co.
3. Modern Metal Products by Muckle.
4. Potter-Roemer, Inc.
5. Samson Metal Products, Inc.

2.2 FIRE EXTINGUISHERS

A. General: Provide fire extinguishers for each cabinet and surface mounting condition at locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.

B. Multipurpose Dry Chemical Type: UL-rated 2A-10B:C, 5-lb nominal capacity.

C. Class K, Wet Chemical Type: UL-rated for 2-1/2 gallon nominal capacity.

2.3 MOUNTING BRACKETS

A. Brackets: Designed to prevent accidentally dislodging extinguisher, of sizes required for type and capacity of extinguisher indicated, in plated finish.

1. Provide brackets for extinguishers not located in cabinets. As indicated on drawings as surface mounted type, standard brackets for the extinguisher type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's printed instructions for installation.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities, but with top not higher than 5' above and with clearance between the floor and the bottom of extinguisher not less than 4".

1. Fasten mounting brackets to structure, square and plumb.

END OF SECTION 104416

SECTION 107500 - FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Aluminum flagpoles.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete footings for flagpoles, if any, and if not specified in this Section.
2. Division 7 Section "Sheet Metal Flashing and Trim" for flashing at roof-mounted flagpoles.
3. Division 7 Section "Joint Sealants" for elastomeric sealant filling the top of the foundation tube, if any.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads as determined according to the building code in effect for this Project or NAAMM FP 1001, "Guide Specifications for Design Loads of Metal Flagpoles," whichever is more stringent.

1. Base flagpole design on maximum standard-size flag suitable for use with pole or flag size indicated, whichever is more stringent.
2. Basic Wind Speed: For Project location, 80 mph (36 m/s).

1.4 SUBMITTALS

A. Product Data: For each type of flagpole required. Include installation instructions.

B. Shop Drawings: Show general layout, jointing, grounding method, and anchoring and supporting systems.

1. Include details of foundation system for ground-set poles.

C. Structural Calculations: For flagpoles indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Finish Samples for Verification: For each finished metal used for flagpoles and accessories.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each flagpole as a complete unit from a single manufacturer, including fittings, accessories, bases, and anchorage devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy kraft paper or other weathertight wrapping and enclose in a hard fiber tube or other protective container.

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:

1. Baartol Co., Inc.
2. Concord Industries, Inc.
3. Eder Flag Manufacturing Co., Inc.
4. Ewing: John Ewing & Co. Inc.
5. ICC Manufacturing Co.; Morgan-Francis Div.; AABEC Pole Div.
6. Kearney-National Inc.; American Flagpole Div.
7. Lingo, Inc.; Acme Flagpole Co. Div.
8. Michigan Flagpole Inc.
9. Olympus Flag & Banner; EMC Div.
10. PLP Composite Technologies, Inc.
11. Pole-Tech Co., Inc.
12. Better Buy Flag Co., Lapeer, Michigan (1-8000-244-3443)

2.2 FLAGPOLES

A. Pole Construction, General: Construct poles and ship to Project site in one piece, if possible. If more than one piece is necessary, provide snug-fitting precision joints with self-aligning, internal splicing sleeve arrangement for weathertight, hairline field joints.

B. Aluminum Flagpoles: Fabricate from seamless, extruded tubing complying with ASTM B 241 (ASTM B 241M), alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm). Heat treat after fabrication to comply with ASTM B 597, temper T6.

1. Provide cone-tapered aluminum flagpoles (1) 25 ft. high and (1) 20 ft. high above ground.
2. Finish: Bronze Anonized

C. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.0635-inch (1.6-mm) minimum wall thickness, sized to suit flagpole and installation. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.

D. Provide flashing collar of same material and finish as flagpole.

E. Provide ground spike at pavement-mounted metal flagpoles.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match pole-butt diameter.

1. 0.063-inch (1.6-mm) spun aluminum, finished to match flagpole.

B. Internal Halyard, Cam Cleat System: 5/16-inch- (8-mm-) diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Provide one halyard and one cleat at each flagpole.
2. Provide cast-metal cleat covers, finished to match flagpole, secured with cylinder locks.

C. Halyard Flag Snaps: Provide 2 swivel snap hooks per halyard, as follows:

1. Anodized clear aluminum.
2. Provide with neoprene or vinyl covers.

D. Flags:

1. 5' x 8' U.S. Flag - Polyester (1).
2. 4' x 6' State of Michigan Flag - Polyester (1).

2.4 MISCELLANEOUS MATERIALS

A. Concrete: Comply with requirements of Division 3 Section "Cast-in-Place Concrete."

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

C. Sand: ASTM C 33, fine aggregate.

D. Elastomeric Sealant: Comply with requirements of "Joint Sealants", Section 079200.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Aluminum: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Medium Bronze Anodized Finish: Provide medium bronze anodized finish (AA-M32); complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare in-ground flagpoles by painting below-grade portions with a heavy coat of bituminous paint.

B. Excavation: For foundation, excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure forms, foundation tube, fiberglass sleeve, or anchor bolts in position, braced to prevent displacement during concreting.

D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than 7 days or use a nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to base perimeter.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric sealant and cover with flashing collar.

END OF SECTION 10350

SECTION 123531 - DECORATIVE LAMINATE CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and general requirements, apply to this Section.

1.2 DESCRIPTION

A. Work Included:

1. Work in this section includes, but is not limited to, all materials, labor and equipment required to furnish, deliver and install all decorative laminate casework, countertops, shelving and fillers.
2. Furnish and deliver for installation by the mechanical contractor all bowls, faucets, strainers, gas, air and vacuum cocks, cupsinks and electrical outlets attached directly to decorative laminate casework.

B. Related Sections:

1. Division 6 Section 061000 "Rough Carpentry".
2. Division 6 Section 064023 “Interior Architectural Woodwork”.
3. Division 9 Section 096513 "Vinyl Base".
4. Division 22 Section "Plumbing".
5. Division 26 Section "Electrical".

1.3 QUALITY ASSURANCE

A. Comply with all provisions of the specifications for the design, quality, testing manufacture and installation of decorative laminate casework and specified equipment.

B. All decorative laminate casework herein specified and shown on the drawings shall meet the standards of quality, materials, construction, workmanship and finish in accordance with AWI Section 400 Specifications for Premium Grade Casework and AWI Section 1600B-S-1 for Modular Casework.

C. All decorative laminate casework herein shall be the project of one manufacturer and shall be the one on which this specification is based. Any substitution MUST have written approval from the Architect at least TEN (10) days prior to the bid due date. All manufacturers not specified shall provide evidence of having a minimum of five (5) years’ experience in the manufacture and installation of decorative laminate casework. In addition they shall furnish a complete list of ten (10) projects of comparable size that they have installed within the last five (5) years, along with a current financial report of their ability to fulfill this contract.

D. The manufacturer shall, for a period of one year from date of shipment, warrant all parts of product manufactured and furnished against manufacturing defects in material and workmanship. Any such parts which under normal use prove defective within the warranty period will be repaired or replaced at the manufacturer’s expense.

1.4 SUBMITTALS

A. All manufacturers, other than those specified, will be required to submit to the Architect and Owner, at their own expense, the following samples for approval at least ten (10) days prior to the bid due date:

1. Samples

a. The contractor shall submit 4" x 4" piece of specified countertop, including external corner.
b. All color samples from manufacturer's standard samples.
c. Hardware and accessories shall include sample handles, hinges, catches and drawer rollers.
d. Failure to submit or comply with the above provisions for prior approval will be the basis for disqualification. Samples of the approved manufacturer will be kept at the job site or the office of the Architect until final completion of the project.

2. Shop Drawings

a. Identify location of all casework.
b. Detail decorative laminate casework in relation to location on site.
c. Locations for roughing in of plumbing, including sinks, faucets, strainers, and electrical devices.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle decorative laminate casework to prevent damage and disfigurement.

1. Protect all surfaces from damage during transit.

1.6 STYLE OPTION

A. All plastic laminate cabinetry shall have the option of an offset overlay design or full overlay design, dependant upon hinge requirements. As selected by the Architect or Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Laminated Components:

1. High pressure plastic laminate, type GP28, for exterior cabinet and exposed surfaces shall meet ALA and NEMA testing standards for vertical grade laminate.
2. High pressure plastic laminate .050" thick shall be used on all countertops. Neutral colored backing sheet shall be used for balanced construction.
3. Thermal fused melamine laminate may be used in vertical exterior applications when its performance characteristics shall meet ALA 1988 and NEMA LD3-1991-GP28 minimum performance test requirements.
4. White thermally fused melamine laminate shall be used for semi-exposed cabinet interiors.

B. High Performance Particle Board Core

1. Particle board shall be 45-47 lb. density employing balanced construction with moisture content no greater than 8%. All particle board shall meet or exceed the requirements for its type and classification under Commercial Standard CS-236-66, Federal Specifications LLL-B-800A and ASTM D 1037-78.

2. Particle Board shall meet the following performance requirements:

a. Screw Holding Face: 371 lbs.
b. Modulus of Rupture: 2,400 psi
c. Surface Hardness: 900 lbs.

2.2 FABRICATION

A. Cases:

1. All decorative laminate cases shall be fabricated of white thermofused Melamine surfaced material. All sides, tops, bottoms, shelves and rails shall be 3/4" thick. All shelves over 36" shall be 1" thick. Shelves shall be finished in white thermofused Melamine top and bottom. Case backs shall be 3/8" thick. Backs shall be dadoed into the case on four sides and secured with rigid adhesive. All base cabinet framing members shall be assembled with dowels and rigid adhesive. All tall and base cabinets shall be fabricated with integral sub-bases. All integral base recesses shall be 4" high x 3" deep. Toe base fronts shall be applied in continuous lengths after cabinet line is installed. All wall and tall cabinets' tops and bottoms shall be assembled with dowels and adhesive and shall be flush with the sides of the cabinets. Case edge banding shall be impact resistant rigid PVC edging in matching or contrasting colors of exterior and drawer and door fronts.

B. Doors:

1. All doors shall be fabricated to finish 3/4" thick. Door exterior shall be vertical grade high pressure laminate. Interior surface of door shall be finished in a white vertical grade high pressure laminate for balanced construction. Finish matching interior.

C. Drawers:

1. Drawer front shall be fabricated to finish 3/4" thick. Drawer front exterior shall be vertical grade high pressure laminate. Interior part of drawer front shall be finished in a white vertical grade high pressure laminate for balanced construction. Finish matching interior. Drawer back and sides shall be fabricated from ½" thick particle board with a white thermofused melamine finish, assembled with dowels and adhesive. Drawer bottom shall be 1/4" thermofused melamine top and bottom, captured on four sides and secured with a rigid adhesive. Drawer slide shall be finished in a white epoxy powder coating. When fully extended, the drawer system shall be held in place by double stops to prevent accidental removal. An integral self-closing/stay closed feature shall be part of each drawer. Each drawer shall be rated for a minimum of 100 lb. loading. File drawers shall be rated for a minimum of 150 lb. loading.

D. Shelf System.

1. All adjustable shelves shall be finished on front edge with PVC impact resistant banding. Each shelf shall be supported by the use of four shelf clips. A steel shank support clip (rated at 1650 lbs minimum load) or plastic double pin shelf clip will be used to support all adjustable shelves. All cabinet sides shall be drilled in a pattern on 32-mm centers to receive adjustable shelves.

E. Hardware

1. All door cabinetry shall have a choice of hinges for the particular style of cabinetry chosen.

a. Type-A: Concealed Hinge (for Full Overlay Design)

1) All hinges shall be clip-on type concealed self-closing with a 110 degree swing. Zinc die cast hinge cups shall have nylon expansion inserts provided in door for positive screw attachment. Hinges shall be nickel plated. Doors shall be capable of being mounted to the cabinet without tools. All hinges shall have the capability of adjustment in all three dimensions, all independent from each other. Doors 48" high and taller shall have three hinges per door.

2. Drawer Slides

a. All drawer slides shall be, at minimum, 100 lb. Capacity side mounted steel type with wrap-around feature to allow for attachment to drawer bottom. Drawer slide and case slide shall be roller type, positive in action, permitting drawer to be fully opened yet preventing drawer from accidental removal by integral stops. Drawer and case slide shall be epoxy powder coated. All drawer slides shall be fabricated with the self-closing/stay closed feature.

3. Drawer and Door Pulls

a. Wire pulls shall be available in satin or polished finish, chrome or brass.
b. Molded wire type plastic pulls shall be available in putty, black, gray and white colors to match hinges.

4. Locks

a. Locks, where shown on drawings, shall be camp type locks in a chrome or black matte finish. All locks shall have removable cores. Locks available master keyed or grand master keyed with 500 key change possibilities. Two keys shall be supplied with each lock.

2.3 FINISH

A. All exposed exteriors of doors, drawers and finished end panels shall be surfaced with vertical grade GP 28 thick high pressure decorative laminate. Thermal fused melamine laminates may be specified for exterior surfaces within Manufacturer’s standard line. Color choice shall be taken from the Wilsonart, Formica, or Nevamar plastic laminate color palette of solid and wood grain patterns only in standard finish. All other brands and finishes shall carry a premium pricing.

B. All exposed case edges shall be in matching colors of the exterior drawer and door fronts in PVC rigid vinyl edging.

C. All semi-exposed interior surfaces shall be thermal fused melamine laminate complying with MEMA test ratings. Color shall be white or almond. NO SUBSTITUTIONS.

D. Unexposed cabinet ends shall be thermofused melamine on both sides for a balanced construction.

E. Interior backs of cabinets shall be fabricated with thermofused melamine.

F. Wall cabinet bottoms and interior of open cabinets to be finished in vertical grade laminate matching exposed exterior color.

2.4 DOOR AND DRAWER EDGING

A. All doors and drawers shall have the option on the following edge treatments:

1. PVC Edging

a. All exposed drawer and door edges shall be finished in a high impact rigid .020-mm PVC edging in matching or contrasting colors of the exterior drawer and door fronts.

2. 3-mm Edging

a. All exposed drawer and door edges shall be edged with a contrasting rigid 3-mm PVC for maximum durability. The 3-mm thick edging shall be hot melt applied and shaped to provide radius front edge. Available in third standard colors.

2.5 COUNTERTOPS

A. Laminated Plastic

1. Refer to Section 064023-4 for counter top specifications.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 123531

SECTION 124813 - FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Frames to be set in concrete floors to receive recessed floor mats.
2. Recessed floor mats of the following type:

a. Vinyl link-type mats.

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

1. Division 3 Sections for concrete work, including forming, placing, and finishing concrete floor slabs and grouting frames into recess.

C. Products furnished but not installed under this Section include frames for floor mats to be set in concrete floor slabs.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of floor mat and frame specified, including manufacturer's specifications and installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing layout and types of floor mat and frames, full-scale sections of typical installations, details of patterns or designs, anchors, and accessories.

1. Coordinate shop drawing submittal with concrete work shop drawings showing oversized recess for deferred installation of frames.

D. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual sections of floor mat and frame materials, showing full range of colors, textures, finishes, and patterns available, for each type of floor mat and frame indicated.

E. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats.

1.4 PROJECT CONDITIONS

A. Field Measurements: Check actual framed openings for mats by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid a delay of the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication without field measurements. Coordinate floor construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain floor mats and frames from one source of a single manufacturer.

1.6 SEQUENCING AND SCHEDULING

A. Provide oversized recesses in concrete work to receive frames. Defer frame installation until building enclosure is complete and related interior finish work is in progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Vinyl Link-Type Mats:

a. American Floor Products Company, Inc.
b. Cactus Mat Mfg. Company.
c. Durable Mat Mfg. Company.
d. R.C. Musson Rubber Company.
e. Pawling Corp.
f. Tennessee Mat Company, Inc.
g. U.S. Mat and Rubber Company, Inc.

2.2 MATERIALS

A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. Where not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.

1. Provide mats with custom inlaid or woven-in graphic (design, logo, emblem, characters, or other graphic) as shown and where shown on contract drawings.

B. Recessed Mat Frames: Size and style to fit floor mat type matching approved sample, for permanent recessed installation in floor, complete with corner pins or reinforcing and installation anchorages.

C. Vinyl Link-Type Mats: 3/8-inch- or 7/16-inch-thick reversible vinyl link mats of following design and construction, with vulcanized edge-nosing trim and steel reinforced end trim.

1. Design: Heelproof solid weave (no openings) made up of rectangular units or continuous strips.

2. Link Rods: Galvanized spring-steel wire.
3. Link Rods: Stainless steel wire.
4. Square Edge Flexible Frame: 2-inch-wide tapered flexible vinyl edge-frame members, attached to mat at all 4 edges, with welded mitered corners. Adjust elevation of concrete substrate to allow flush condition of mat frame with adjacent finish floor surface.

2.3 FABRICATION

A. Shop-fabricate units of floor mat work to greatest extent possible in sizes as indicated. Where not indicated otherwise, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints. Where possible, verify sizes by field measurement before shop fabrication.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install recessed frames and mats complying with manufacturer's instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

B. Where frame is embedded in grout, install necessary shims, spacers, and anchorages for proper location and secure attachment.

C. Install surface-type units to comply with manufacturer's instructions at locations indicated and coordinated with entrance locations and traffic patterns.

1. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

3.2 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near time of Substantial Completion.

B. Defer installation of floor mats until time of Substantial Completion for Project.

END OF SECTION 124813

SECTION 21 05 00 – BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to Division 00 Bidding and Contract Requirements, and to Division 01 General Requirements, which are hereby made a part of this Section.

B. SPECIFICATION INDEX

21 05 00	Basic Mechanical Requirements
22 05 23	General Duty Valves for Plumbing & Piping
22 05 29	Hangers and Supports for Plumbing, Piping and Equipment
22 05 53	Identification for Plumbing, Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 11 16	Domestic Water Piping
22 11 19	Domestic Water Piping Specialties
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties
22 33 00	Electric water heaters
22 42 13	Commercial Water Closets
22 42 14	Commercial Urinals
22 42 16	Commercial Lavatories
22 42 17	Commercial Sinks
22 47 16	Electric water coolers
23 05 00	Common Work Results
23 05 93	Testing, Adjusting and Balancing for HVAC
23 07 13	Duct Insulation
23 07 19	HVAC piping insulation
23 11 23	Facility Natural gas piping
23 23 00	Refrigerant Piping
23 31 13	Metal Ducts
23 33 00	Air Duct Accessories
23 37 13	Diffusers, Registers, and Grilles\
23 54 00	Furnaces
23 74 13	Rooftop Units

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division Section "common work results" for materials and methods common to the remainder of specification, plus general related specifications including:

    a. Access to mechanical installations.

b. Substitution of equipment, see also Division 0I.
c. Project phasing

2. Sheet Index:

M-1: Mechanical Title Sheet
M-2: Floor plan demolition
M-3: Floor plan underground plumbing and piping
M-4: Floor plan plumbing and piping
M-5: Floor plan HVAC
M-6 Details and schedules

C. Overview of Mechanical Scope of Work

1. Provide new rooftop unit, thermostat, ductwork, concrete pad, grilles and diffusers, gas piping
2. Provide furnaces and condensing units, ductwork, grilles and diffusers, refrigerant piping, thermostats, gas piping
3. Provide new plumbing sanitary, vent piping, hot water, and cold water piping , insulation and labels
4. Provide gas piping
5. Provide new floor drains, inline trap primers.
6. Provide new water closets and urinals including carriers, sanitary & vents piping and cold and hot water piping, insulation, pipe labels etc.
7. Provide new lavatories including battery / sensor operated faucet, chrome plated traps, risers, stops etc. Provide PH insulation kit and mixing valve
8. Provide new ductwork, grilles, volume dampers, insulation etc.
9. Provide exhaust fans, ductwork, wall caps.
10. Provide air balance reports.
11. Provide check test and start up.
12. Provide as-built drawings.
13. Provide shop drawings.
14. Provide warranty.
15. Provide Owner training, O & M manuals.

1.3 SUBMITTALS

A. General: Follow the procedures specified in Division 01 Section 01040 "SUBMITTALS."

B. For brochures and other non- reproducible forms of Shop Drawings, submit for review the required number of Shop Drawings for each piece of equipment and/or apparatus to be used, together with such description and/or explanatory notes as may be required to give a clear idea of its arrangement and construction.

C. Submit all Shop Drawings electronically in PDF format.

D. No apparatus or equipment shall be shipped from stock or fabricated until shop drawings for same have been reviewed and accepted.

E. Include performance curves and certified ratings on equipment with Shop Drawing submittals.

F. Submit for approval, shop drawings for all equipment, materials, valves, plumbing and heating specialties, wiring diagrams and control diagrams including, but not limited to the items listed below. Where items are referred to by symbol numbers on the drawings and Specifications, all submittals shall bear the same symbol number and shall contain the project name, and project number. No loose sheets shall be submitted unless a cover sheet is attached.

1. Plumbing fixtures
2. Plumbing accessories
3. HVAC system
4. HVAC system accessories
5. Grilles, diffuser and registers
6. Exhaust fans
7. Rooftop unit
8. Furnaces
9. Condensing units

1.4 RECORD DOCUMENTS

1. Prepare record documents in accordance with the requirements in Division 01 Section 01705 "PROJECT CLOSEOUT" including as-built drawings, O & M manuals, shop drawings, permits etc.

1.5 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 01 Section 01705 "PROJECT CLOSEOUT." In addition to the requirements specified in Division 01, 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. Copies of all approved shop drawings.

1.6 PERMITS AND INSPECTIONS

A. The Mechanical Trades shall pay for all necessary permits, & fees necessary for this branch of work.

B. All materials and workmanship shall comply with all applicable codes, specifications, Federal laws, State laws, local ordinances, industry standards, utility company regulations and the Contract Documents. Where requirements vary, the most stringent shall govern.

C. In addition to the above requirements, the Mechanical Trades shall notify the Architect/Engineer in writing prior to submittal of this bid of any changes required in the Drawings and/or Specifications in order to comply with laws, codes, ordinances and regulations applicable to the Mechanical Trades Work.

D. After entering into the Contract, the Mechanical Trades will be held to complete all work necessary to meet the requirements of said laws, codes, etc., without additional compensation. When the work required by the Drawings and Specification exceeds that required by said laws, etc., then the requirements of the Drawings and Specifications shall take precedence.

E. Non-Compliance - Should the Mechanical Trades perform any work that does not comply with the requirements of the applicable building codes, State laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencis

1.7 STANDARD SPECIFICATIONS

A. The chemical and physical properties of all materials and the design performance characteristics and methods of construction of all items of equipment shall be in accordance with the requirements of the latest issue of the various applicable Standard Specifications at the time of bid.

B. These Standard Specifications have been prepared by authorities who are recognized by the Mechanical Trades. The names of these authorities are listed below, together with the well known abbreviations of their names, as they appear in the following Specifications:

1. AABC - Associated Air Balance Council.
2. AMCA - Air Moving and Conditioning Association.
3. AGA - American Gas Association.
4. ANSI - American National Standards Institute.
5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
6. ASME - American Society of Mechanical Engineers.
7. ASTM - American Society of Testing Materials.
8. AWS - American Welding Society.
9. AWWA - American Water Works Association.
10. AFBMA - Anti-Friction Bearing Manufacturers Association.
11. FM - Factory Mutual Engineering.
12. NEC – 2011 National Electrical Code as amended by the Michigan code rules part B
13. NEBB - National Environmental Balancing Bureau.
14. NEMA - National Electrical Manufacturers Association.
15. NFPA - National Fire Protection Association.
16. SMACNA - Sheet Metal and Air-Conditioning Contractors National Association.
17. UL - Underwriters' Laboratories, Inc.
18. Michigan Plumbing Code 2012
19. Michigan Mechanical Code 2012
20. Michigan Building Code 2012

1.8 MECHANICAL DRAWINGS

A. Contract Drawings for Mechanical Work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping and approximate sizes and locations of equipment and outlets. Do not scale Drawings for measurements. Verify all locations of existing piping, air terminal units, thermostats, ductwork, etc. in the field.

B. The Mechanical Trades shall follow the Drawings in laying out his work, consult Architectural and Electrical Construction Drawings to familiarize himself with all conditions affecting his work and shall verify all spaces in which their work will be installed.

C. Where job conditions require reasonable changes in indicated locations or arrangements, make changes without additional cost to the Owner.

D. The Mechanical Drawings and Specifications are to be cooperative and whatever is called for by either shall be binding as if called for by both.

E. The Mechanical Trades shall consult the Electrical Specifications and Drawings to determine the extent of the facilities equipment wiring being furnished by that trade and shall provide any additional services required to make a complete and operable system.

F. The Mechanical Trades shall maintain/prepare coordination drawings between all Trades for work above. Coordination drawings shall be in conformance to Division 01 Section "Project Coordination."

1.9 USE OF EQUIPMENT

A. The use of any equipment or any part thereof, for purposes other than testing, even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor shall it be construed to obligate him in any way to accept improper work or defective materials.

1.10 PLACEMENT OF ORDERS

A. No consideration will be given to requests for substitutions because of delivery problems, unless the Mechanical Trades can prove beyond doubt that orders were placed as soon as possible after contract was let.

1.11 DEFINITIONS

A. Indicated: The term "indicated" is a cross-reference to graphic representations, notes or schedules on the Drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for the purpose of helping the reader locate the cross-reference, and no limitation of location is intended except as specifically noted.

B. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations."

C. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect-Engineer", "requested by the Architect-Engineer", and similar phrases.

D. Approve: Used in conjunction with action on submittals, applications, and requests, is limited to the Architect-Engineer duties and responsibilities stated in General Conditions and modification thereto.

E. Regulation: Includes 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.

F. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, and made ready for the intended use."

G. Installer: "Installer" is the Contractor or an entity engaged by the Contractor as employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform. The term "experienced" when used with "Installer" means having a minimum of 5 previous Projects similar in size to this Project and being familiar with the precautions required and with requirements of the authority having jurisdiction.

H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

I. The Work: The term "work" means the construction and services required by the contract documents, whether completed or partially completed, and included all other labor, materials, equipment and services

provided or to be provided by the Contractor to fulfill the Contractor's obligations. The work may constitute the whole or a part of the project.

J. The Project: The project is the total construction of which the work performed under the contract documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

K. Project Site: Is the space available for construction activities, either exclusively or with others performing other construction on the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

1.12 GUARANTEE

A. Mechanical Trades guarantees that the installation is free from mechanical defects and agrees to replace or repair, to the satisfaction of the Owner, any part of this installation which may fail within a period of one year after final acceptance, provided that such failure is due to defects in the materials or workmanship or to failure to follow the specifications and drawings. The Mechanical Trades shall file with the Owner any and all guarantees from the equipment manufacturers and what operating conditions and performance capacities they are based on.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in all Divisions for various rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, including materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components and the Architectural phasing plan
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations and phasing
4. Coordinate the installation of required supporting devices, roof curbs and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. 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/Engineer.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
11. Install access panel or doors where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01 Section 01045 "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Owner Representative Observation of concealed Work.

C. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 COOPERATION WITH OTHER SUB-TRADES

A. Before proceeding with installation of this work, the Mechanical Trades shall consult all Drawings covering the various other trades, the field layouts of these trades and their Shop Drawings. He shall be governed accordingly in layout of this work. Access to these Plans, Layouts and Drawings can be obtained in the field from all trades.

B. The Mechanical Trades shall cooperate with all Sub-Trades for other trades to avoid interferences in the work and to avoid delays in the construction.

C. Interferences which occur as a result of poor cooperation and coordination shall be resolved by the General Contractor. Such changes will not be considered as extras and shall be done at the expense to the responsible Trades.

D. Acoustical Ceiling Tile and/or Mechanical and Electrical Trades shall be coordinated so that all outlets and/or fixtures installed at ceiling shall present a properly coordinated and neat appearance.

3.5 COORDINATION BETWEEN MECHANICAL TRADES AND SUPPLIERS OF MISCELLANEOUS EQUIPMENT REQUIRING MECHANICAL SERVICES.

A. Unless otherwise specified, equipment so stated to be furnished by other trades in these Specifications will be furnished, assembled and set in place by Architectural Trades or under separate contract.

B. The Mechanical Trades shall obtain approved rough-in Drawings and detailed instructions before commencing his work.

3.6 EQUIPMENT SCHEDULES

A. The equipment scheduled on the drawings is intended to indicate the quality and type of equipment to be supplied.

B. Where the Specifications vary from the schedules, the schedules shall apply.

C. All packaged unit equipment and skid mounted mechanical components that are factory assembled shall meet, in detail, the products named and specified within each section of the detailed mechanical and electrical specifications.

D. All items on the drawings are designed around base bid items. If contractor uses equipment other than base bid, he shall coordinate with the other Trades before submitting his bid. Contractor is responsible for any revisions required due to increased weight, size, power difference, etc.

E. Manufacturer's products specified on the drawings were used for design purposes. Other manufacturer's products equal in required performance, construction, and other features may also be used. A

3.7 EQUIPMENT INSTALLATION

A. The Mechanical Trades shall coordinate the delivery of the equipment with the other trades so that it can be readily placed in its location before enclosing structure is completed.

B. The Mechanical Trades shall provide the equipment in a suitable knocked down condition for placement in the structure as dictated by existing accesses.

C. Any costs incurred by the failure of the Mechanical Trades to comply with the above shall be at his own expense.

3.8 EQUIPMENT CONNECTIONS

A. Connections to equipment, fixtures, etc., shall be made in accordance with the Shop Drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. Total number of type of services required may vary slightly above or below number shown on the Drawings, but these services shall be installed by the Mechanical Trades as part of this contract and at no additional cost to the Owner.

3.9 RECEIPT OF PORTABLE AND DETACHABLE PARTS

A. The Mechanical Trades shall retain all portable and detachable portions of the installation, such as keys, spare accessories, operating manuals, one (1) complete set of approved Shop Drawings, etc., in his possession until the completion of the work and is then to turn them over to the Owner and obtain signed, itemized receipts. These receipts shall be attached to the Mechanical Trade's request for final payment.

3.10 PROTECTION OF EQUIPMENT

A. Responsibility for care and protection of all Mechanical Work rests with the Mechanical Trades until it has been tested and accepted.

B. After delivery, before and after installation, protect equipment and materials against theft, injury or damage from all causes.

C. Protect equipment outlets with temporary plugs, caps, or burlap.

D. The Mechanical Trades shall receive, properly house, handle, hoist, deliver to proper location, equipment and other materials required for his contract.

3.11 PROTECTION FROM FREEZING

A. During freezing weather, the Mechanical Trades shall protect all his materials in such a manner that no harm can be done to the installation already made and/or materials and equipment on the job. He shall furnish any necessary protection for such installation and/or equipment as may be required.

3.12 DAMAGE TO OTHER WORK

A. The Mechanical Trades shall be responsible for all damage done by his workmen to the work of other trades. Patching and repairing of damaged work shall be done by the Trade which originally installed same, but the Mechanical Trades shall bear the expense.

B. The Mechanical Trades shall also be held responsible for damage done to existing equipment, structures, pipes, etc., which damage is a direct or indirect result of their work and their workmen. Such damage will be repaired under the direction of the General Contractor at the expense of the Mechanical Trades.

3.13 REFERENCE TO DESIGN SCHEDULES

A. Mechanical Trades shall refer to Equipment Schedules for Drawing unit identification number and corresponding area locations, capacity and design requirements.

B. Wherever schedules or notes appear on the Drawings or in the Specifications, in which sizes and capacities of equipment are indicated, the equipment furnished and installed under this Contract shall meet the following requirements under operating conditions:

1. The RPM, the outlet velocities, tip speeds and the decibel ratings specified are the maximum that will be accepted.
2. The motor horsepower, the CFM, the static pressure on fans, the GPM and the total head on pumps and heating and cooling capacities are the minimum that will be accepted.

C. The Mechanical Trades shall be held responsible to see that all equipment, or materials, submitted for approval meet the requirements. After the equipment or materials have been installed and tested under

operating conditions, if it is found that they do not meet the requirements specified above, the Mechanical Trades shall remove all such equipment and/or materials that do not meet the specified conditions and replace them with the proper equipment without additional cost to the Owner.

3.14 EQUIPMENT INSTALLATIONS AND DESIGN

A. Certain equipment must be installed before housing and/or enclosures are installed or completed. Doors and other access openings, in some case, are not large enough to permit passage of the equipment completely assembled.

B. Investigate these conditions prior to fabrication or shipment.

C. The equipment to be furnished under this Division of the Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be the product of a single manufacturer.

D. Where this is not possible, it shall be brought to the attention of the Architect/Engineer for his disposition.

E. Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with applicable technical standards, suitable for maximum working conditions and shall have a neat and finished appearance.

3.15 WORK INVOLVING OTHER TRADES

A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades such as Electrical Trades or Architectural Trades due to code requirements or union jurisdictional requirements. Where this occurs, the Mechanical Trades shall include the full cost for completing the work and pay the cost of doing the work to the respective trade he hires to do the actual work unless indicated otherwise in the specifications.

3.16 CLEANING OF EQUIPMENT

A. At the time of completion, clean the interior of all piping of all mud, debris, etc. In addition, clean the interior and exterior surfaces of all equipment and touch-up damaged painted surfaces.

3.17 ACCESS TO EQUIPMENT

A. All control devices, specialties, etc., shall be so located as to provide for easy access for operation, repairs and maintenance.

3.18 OPERATING INSTRUCTIONS

A. Instruct the Owner's personnel in the care, operation and maintenance schedule of all apparatus and equipment. Instructions shall be given verbally at the job site by a qualified, experienced representative of the Mechanical Trades, and shall be specific to this project. A minimum 4-hour training session shall be done for the Owner's selected staff.

3.19 ADJUSTMENTS

A. After all testing has been completed and the installation declared satisfactory by the Architect/Engineer, put all the systems in proper adjustment and operation.

B. Check all motors for proper rotation prior to running.

C. Check all bearings for lubrication and lubricate if required.

D. Check all motors and bearings for overheating and make necessary adjustments if required.

E. Provide for one set of replacement filters for the rooftop unit and each furnace

3.20 CLEANING AND FINISHING

A. During the construction period, the Mechanical Trades shall remove all debris, rubbish, tools, equipment, unused materials, etc., as required and/or requested by the Owner. Any such removal, etc., shall be paid for by the Mechanical Trades.

B. Upon completion, the entire installation shall be thoroughly cleaned, all rubbish removed and the installation left to the satisfaction of the Owner.

C. Keep the premises in a clean and orderly condition during construction, removing all dirt, debris, etc., insofar as such is as result of this work.

D. After the cleaning and decorating of the building has been completed, thoroughly clean all mechanical equipment, to completely remove "construction dust and dirt" from them. Conduct a final inspection of the work, and insure that the piping has been cleaned and placed in complete and satisfactory working order.

E. Two (2) weeks after turning the system over to the Owner, return to the building and clean and check all equipment, controls, and accessories.

3.21 WORK DURING AN EMERGENCY

A. The Mechanical Trades shall perform any work and shall furnish and install any materials and equipment necessary during an emergency endangering life or property. In all cases they shall notify the Architect/Engineer of the emergency as soon as practicable, but they shall not wait for instructions before proceeding to properly protect both life and property.

END OF SECTION 21 05 00

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Globe valves.
   2. Swing check valve
   3. Gate valves
   4. Ball valves

1.2 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Hand wheel: For valves other than quarter-turn types.
   2. Hand lever: For quarter-turn valves NPS 6 and smaller except plug valves.
   .

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

   1. Gate Valves: With rising stem.
   2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Solder Joint: With sockets according to ASME B16.18.
   3. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.4 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Composition.
g. Seat Ring: Bronze.
h. Disc Holder: Bronze.
i. Disc: PTFE or TFE.
j. Gasket: Asbestos free.

2.5 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.

c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded **or** solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

B. Class 125, RS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.6 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 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.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.
2. Throttling Service: Globe or ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze or nonmetallic disc.
3. Ball Valves: One piece, full port, bronze with bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze or nonmetallic disc.
5. Bronze Gate Valves: Class 125, RS
6. Bronze Globe Valves: Class 125, bronze or nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal or nonmetallic seats.
3. Iron Swing Check Valves with Closure Control: Class 125, lever.
4. Iron Gate Valves: Class 125, OS&Y.
5. Iron Globe Valves: Class 125.

END OF SECTION 220523

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING, PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 0I Specification Sections.

B. Product data for hangers and supports.

C. Welding Certificate: Copies of certificates for welding procedures and operators.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code–Steel."

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.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.

1. Manufacturers:

    a. Carpenter & Patterson, Inc.
    b. Grinnell Corp.
    c. Michigan Hanger Co., Inc.
    d. Globe Inc.
    e. Empire Inc.
    f. National Pipe Corp.

2. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

1. Manufacturers:

a. Carpenter & Patterson, Inc.
b. Michigan Hanger Co., Inc.
c. Pipe Shields, Inc.

2. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
3. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
6. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification 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.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification 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 deg F piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification 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. 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.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes. Support pipes of various sizes together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners 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.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. 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.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. 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.

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.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 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.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations. 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.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching 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. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils. See Division 01 Section "Painting" for paint materials and application requirements.

B. 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 220553 – IDENTIFICATION FOR PLUMBING, PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Access panel and door markers.
2. Pipe labels.

1.3 SCOPE OF WORK

A. Label all new piping: cold water, hot water, hot water return, NPW, refrigerant (liquid & gas), condensate drains, gas piping, compressed air piping . Labels to .include flow arrows

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 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 location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 SNAP ON MARKERS

A. Manufacturers standard pre-printed semi rigid color coded pipe markers conforming to ASME A13.1 full band type with flow arrows

B. Approved manufacturers: Seton, Brady or equal

2.2 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Material: Metal or fiberboard.
2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.
4. Color coded with flow arrows

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 PIPING IDENTIFICATION

A. Install pipe markers with permanent adhesive on all piping systems. Identification to match existing system.

B. Pipe Marker: Show service and direction of flow.

C. Locate markers near points where piping enters into concealed spaces and at maximum intervals of 50 feet in each space where pipes are exposed or concealed by removable ceiling system.

3.3 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

END OF SECTION 22 05 53

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot water, cold water, non –potable water and hot water return piping
2. Supplies and drains for handicap-accessible lavatories and sinks
3. Pumped condensate piping and gravity condensate piping

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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 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.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation 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.

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D. Fiberglass Pipe Insulation:

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. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Insulation thickness to comply with ASHRAE 90.1-2007 table 6.8.3.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 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. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F .

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F .
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F .
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
.

1. Width: 3 inches .
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14,.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, :

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Michigan Barrier Free requirements.

B. Protective Shielding Piping Enclosures,(PH lavatories)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with MBF requirements.

PART 3 - EXECUTION

3.1 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.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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, mastics, 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 4 inches o.c.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, 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. Cleanouts.

3.3 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" for 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."

3.4 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. Stencil or 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 gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, 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 (50 mm) 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.

3.5 INSTALLATION OF FIBER-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, 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 cut sections of cellular-glass block insulation of same thickness as pipe 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. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install 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 cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
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3.7 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Water: Insulation shall be fiberglass ASJ :Insulation thickness per ASHRAE standard 90.1-2007 table 6.8.3
1. Hot water supply and return piping: 1”’ thick
2. Cold water and non-potable water piping: 1/2” thick for all sizes with vapor barrier

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:
1. fiberglass, Preformed Removable Pipe Insulation, Type I: 1/2 inch thick with PVC jacket

C. Condensate drains (pumped and gravity): Insulation shall be fiberglass ASJ :Insulation thickness
1. Piping: 1/2”’ thick

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes domestic water piping and fittings.

B. Installation to comply with The Michigan Plumbing Code 2012.

C. Provide new RZP-BFP on the water service

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. Jomar International.
   e. Matco-Norca.
   f. McDonald, A. Y. Mfg. Co.
   g. Watts; a division of Watts Water Technologies, Inc.
   h. Wilkins; a Zurn company.
   i. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
   b. Central Plastics Company.
   c. Matco-Norca.
   d. Watts; a division of Watts Water Technologies, Inc.

e. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F .
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping to permit valve servicing.

H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

L. Install sleeves for piping penetrations of walls, ceilings, and floors.

M. Install sleeve seals for piping penetrations of concrete walls and slabs.

N. Install escutcheons for piping penetrations of walls, ceilings, and floors.

O. Install new water service and lawn irrigation service per local utility water department requirements

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch .

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2 : 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2 : 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

G. Install supports for vertical steel piping every 15 feet.

H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect piping using transition fitting to join dissimilar piping materials.

D. Connect piping to equipment piping, extend and connect to the following:
1. Condensate pumps: Discharge piping to include shut-off valve and check valve.
2. Install trap assembly on HVAC unit drain pan and pipe to condensate pump.
3. Install condensate pump on wall bracket

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill piping. Check components to determine that they are not air bound and that piping is full of water.
b. 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 a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. 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 it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 CLEANING

A. Clean piping as follows:

B. Clean interior of piping system. Remove dirt and debris as work progresses.

3.10 PIPING SCHEDULE

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 and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. HVAC Equipment drains shall be Type L hard drawn copper with removable traps

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Temperature-actuated, water mixing valves.
3. Hose bibs.
4. Drain valves.
5. Water-hammer arresters.
6. Trap-seal primer valves

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers

1. Standard: ASSE 1001.

2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze

B. Hose-Connection Vacuum Breakers :

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices :

1. Manufacturers: Subject to compliance with requirements,
2. :

a. Armstrong International, Inc.
b. Cash Acme; a division of Reliance Worldwide Corporation.
c. Conbraco Industries, Inc.
d. Honeywell International Inc.
e. Legend Valve.
f. Leonard Valve Company.
g. Powers; a division of Watts Water Technologies, Inc.
h. Symmons Industries, Inc.
i. TACO Incorporated.
j. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
k. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig.
5. Type: Thermostatically controlled, water mixing valve.
6. Material: Bronze body with corrosion-resistant interior components.
7. Connections: Threaded inlets and outlet.
8. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Tempered-Water Setting: 105 deg F **adjustable**
10. Valve Finish: Chrome plated.

2.5 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves
1. Pressure Rating: 400-psig minimum CWP.
2. Size: NPS 3/4.
3. Body: Copper alloy.
4. Ball: Chrome-plated brass.
5. Seats and Seals: Replaceable.
6. Handle: Vinyl-covered steel.
7. Inlet: Threaded or solder joint.
8. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.6 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters :

1. Manufacturers: Subject to compliance with requirements,:

a. AMTROL, Inc.
b. Josam Company.
c. MIFAB, Inc.
d. Precision Plumbing Products, Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
g. Tyler Pipe; Wade Div.
h. Watts Drainage Products.
i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type:Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.7 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, inline Trap-Seal Primer Device :

1. Manufacturers: Subject to compliance with requirements,:
2. In line type

a. Sure Seal
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Standard: ASSE 1072.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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 unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

C. Install water-hammer arresters in water piping according to PDI-WH 201.

D. Install inline trap-seal primer in each floor drain, hub out let or floor sink.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements for ground equipment in Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Fire-retardant-treated-wood blocking is specified in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 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 temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

2. Sanitary , waste and vent piping

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

C. Installation to comply with Michigan Plumbing code 2012.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 SANITARY AND VENT PIPE AND FITTINGS

Service weight cast iron with no-hub fittings and stainless steel clamps or schedule 40 PVC with solvent welded DWV

2.3 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-in. maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. 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.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. 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.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Sanitary pipe drop at column to be service weight cast iron

H. Install fittings for changes in direction and branch connections.

I. 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 drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."..

L. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping.

M. Install sleeves for piping penetrations of walls, ceilings, and floors.

N. Install sleeve seals for piping penetrations of concrete walls and slabs.

O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

P. Install drain boxes, floor drains etc. for washers and extractors

3.2 JOINT CONSTRUCTION

A. 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.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern..

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, non-pressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

   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.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting**,** valve**,** and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. 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: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet . Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install cleanout cover and floor drains flush with floor
6. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 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. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

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.

3.8 CLEANING AND PROTECTION

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.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping shall be the following:
1. Service weight cast iron with no-hub DWV fittings

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Roof flashing assemblies.
   4. Miscellaneous sanitary drainage piping specialties.
   5. Flashing materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast-Iron Cleanouts
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. 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: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
   5. Closure: Countersunk **brass** plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. Oatey.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products

2. Standard: ASME A112.36.2M for adjustable housing threaded, cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing].
5. Body or Ferrule: Cast iron
6. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
7. Frame and Cover Shape: Round.
8. Top Loading Classification: Heavy Duty.
9. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Wade
g. Zurn Plumbing Products.

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: Counter sunk brass 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.

2.2 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 Div.
b. MIFAB, Inc.
c. Prier Products, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Wade
h. Zurn Plumbing Products.

2. Standard: ASME A112.6.3.
3. Pattern: Area Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange

6. Anchor Flange
7. Outlet: Bottom.
8. Top or Strainer Material: Nickel bronze.
9. Top Shape: Round.
10. Top Loading Classification: Medium Duty.
11. Trap Pattern: Standard P-trap. Trap Features: Trap-seal primer valve drain connection

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. 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 side inlet.

2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. .0469-inch thickness.

.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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. Use NPS 4 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 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. 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.
3. Install trap primers
4. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. 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.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane. Maintain fire rating of the floor

I. Install vent caps on each vent pipe passing through roof.

3.2 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.

3.3 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:

B. Set flashing on floors and roofs in solid coating of bituminous cement.

C. Secure flashing into sleeve and specialty clamping ring or device.

D. Install flashing for piping passing through roofs with counter lashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 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 temporary plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial, electric, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

B. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

B. Source quality-control reports.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

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. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion..

    a. Commercial, Electric, Storage, Domestic-Water Heaters:

        1) Storage Tank: Five years.
        2) Controls and Other Components: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, domestic-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements,

    a. American Water Heaters.
    b. Bradford White Corporation.
    c. Lochinvar Corporation.
    d. Rheem Manufacturing Company.
    e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
    f. State Industries.
    .

2. Standard: UL 1453.
3. Storage-Tank Construction: Non-ASME-code,

    a. Tapping's: Factory fabricated of materials compatible with tank and piping connections. Attach tapings to tank before testing.

        1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

    b. Pressure Rating: 150 psig .
    c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tapings.

4. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    c. Insulation: Comply with ASHRAE/IESNA 90.1.
    d. Jacket: Steel with enameled finish.
    e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
    f. Temperature Control: Adjustable thermostat.
    g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

2.2 SOURCE QUALITY CONTROL

A. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and re-inspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. .
   1. Maintain manufacturer's recommended clearances.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

   1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

E. Install thermometers on outlet piping of electric, domestic-water heaters.

F. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

G. Fill electric, domestic-water heaters with water.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and re-inspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

END OF SECTION 223300

SECTION 224213- COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets
2. Toilet seats.
3. Carriers

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flush valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

A. Water Closets: Floor mounted 1.1 GPF Tank type

1. Basis-of-Design Product: Subject to compliance with requirements, provide [comparable product by one of the following:

a. American Standard America.
b. Crane Plumbing, L.L.C.
c. Ferguson Enterprises, Inc.; ProFlo Brand.
d. Kohler Co.
e. Mansfield Plumbing Products LLC.
f. Peerless Pottery Sales, Inc.
g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Tank type-pressure assisted.
e. Rim Contour: Elongated.
f. Water Consumption: 1.1 gal**.** Per flush.

g. Color: White.

B. Toilet Seats :

1. Manufacturers: Subject to compliance with requirements,:

a. American Standard America.
b. Bemis Manufacturing Company.
c. Centoco Manufacturing Corporation.
d. Church Seats..
e. Kohler Co.
f. Olsonite Seat Co.
g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard.
5. Shape: Elongated rim, open front.
6. Hinge: Check, Self-sustaining,.
7. Hinge Material: Non-corroding metal.
8. Color: Black.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.

B. Flush-Valve Installation:

1. Install water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.3 ADJUSTING

A. Operate and adjust water closets. Replace damaged and malfunctioning water closets, fittings, and controls.

3.4 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224214- COMMERCIAL URINALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Urinals.
2. Flush valves.
3. Carriers

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manuals

1.4 WALL-HUNG URINALS

A. Urinals Wall hung, top outlet, siphon jet**,** PH accessible.

1. Manufacturers: Subject to compliance with requirements,

a. American Standard America.
b. Ferguson Enterprises, Inc.; ProFlo Brand.
c. Kohler Co.
d. Mansfield Plumbing Products LLC.
e. Peerless Pottery Sales, Inc.

2. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Strainer with integral trap.
e. Water Consumption: 1 gph.
f. Spud Size and Location: NPS ¾ top
g. Outlet Size and Location: NPS 2 back.
h. Color: White.

3. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.

b. Size: NPS 2

c. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

1.5 URINAL FLUSH VALVES

A. Flush valves

1. Manufacturers: Subject to compliance with requirements,:

a. Coyne & Delany Co.
b. Sloan Valve Company.
c. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASSE 1037.
3. Minimum Operating Pressure: 20 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flush Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 1.0 gal. per flush.
9. Minimum Inlet: NPS 3/4
10. Minimum Outlet: NPS ¾

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.

3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flush-Valve Installation:

1. Install flush-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

2.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

2.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls. Adjust water pressure at flush valves to produce proper flow.

2.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials and Install protective covering for installed urinals and fittings.

B. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224214

SECTION 224216- COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA LAVATORIES

A. Lavatory : Vitreous china, wall hung and countertop type, PH Accessible

1. Manufacturers: Subject to compliance with requirements, but are not limited to, the following:

a. American Standard America.
b. Crane Plumbing, L.L.C.

c. Kohler Co.

d. Mansfield Plumbing Products.

e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: see plans
c. Nominal Size: 20” x 18”
d. Faucet-Hole Punching.
e. Faucet-Hole Location: Top.
f. Color: White
g. Mounting Material: Chair carrier.

3. Faucet: Battery/sensor operated CP brass
4. Support: ASME A112.6.1M, lavatory carrier
5. Grid drain and CP trap and risers

2.2 FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets solid-brass valve

1. Manufacturers: Subject to compliance with requirements,:

a. American Standard America.
b. Bradley Corporation.
c. Chicago Faucets.
d. Delta Faucet Company.
e. Elkay Manufacturing Co.
f. Grohe America, Inc.
g. Just Manufacturing.
h. Sloan .
i. Moen Incorporated.
j. Speakman Company.
k. T & S Brass and Bronze Works, Inc.
l. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punching; coordinate outlet with spout and fixture receptor.
4. Body Type: Center set.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate
7. Maximum Flow Rate: 0.5 gpm
8. Mounting Type: Deck, exposed
9. Spout: Rigid
10. Spout Outlet: Aerator.
11. Operation: Compression, manual.
12. Drain: grid
13. Battery operated / sensor faucet

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 3/8
2. Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with and chrome-plated, brass or steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install lavatory per manufacturers recommendations

C. Install accessible lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings

E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Adjust sensor range.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

E. Install batteries, provide spare set.

END OF SECTION 224216

SECTION 224217 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Service sinks.
2. Stainless steel sinks.
3. Sink faucets.
4. Supply fittings.
5. Waste fittings

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 SERVICE SINK

A. Service Basins pre-molded, floor mounted mop basin

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
:

a. Crane Plumbing, L.L.C.
b. Ferguson Enterprises, Inc.; Pro Flo Brand.
c. Florestone Products Co., Inc.
d. Mustee, E. L., & Sons, Inc.
e. Zurn Industries, LLC; Light Commercial Specialty Plumbing Products.

2. Fixture:

a. Standard: IAPMO/ANSI Z124.6.
b. Material: Cast polymer.
c. Nominal Size: 24 by 24 by 10 inches
d. Rim Guard: On all top surfaces.
e. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet: Wall mount faucet with vacuum breaker, pail hook,.

2.2 STAINLESS STEEL SINKS

A. Stainless steel countertop self-rim sinks

1. Manufacturers: Subject to compliance with requirements, [provide products by the following:

   a. Advance Tabco.
   b. Eagle Group; Foodservice Equipment Division.
   c. Elkay Manufacturing Co.
   d. Griffin Products, Inc.
   e. Just Manufacturing.

2. Fixture:

   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Type: Ledge back.
   c. Number of Compartments and size: See schedule on the plans
   d. Metal Thickness: 0.050 inch compartment sinks.
   e. SS Basket style strainer

3. Faucet : Single lever type with spray attachment
   a. Mounting: On ledge, self-rim

4. Supply Fittings:

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

      1) Operation: Loose key.
      2) Risers: NPS 3/8 “chrome-plated copper flexible tube

5. Waste Fittings:

   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap(s):

      1) Size: NPS 1-1/2.
      2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch thick brass tube to wall and chrome-plated brass or steel wall flange.

6. Mounting: On counter with sealant.

2.3 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets Manual type, single-control mixing valve.

1. Manufacturers: Subject to compliance with requirements, provide products by the following :

    a. American Standard America.
    b. Delta Faucet Company.
    c. Elkay Manufacturing Co.
    d. Kohler Co.
    e. Moen Incorporated.
    f. Chicago Faucets..

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture with hole punching; coordinate outlet with spout and sink receptor.
4. Body Material: Commercial, solid brass.
5. Finish: polish Chrome plated.
6. Maximum Flow Rate: 2.2 gpm.
7. Handle: single lever with spray
8. Mounting Type: Deck, exposed.
9. Spout Type: Swing, solid brass, chrome plated.
10. Spout Outlet: Aerator.
11. Lead water filter

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers: NPS 3/8 Chrome-plated braided .

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Basket type strainer with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2
2. Material: Chrome-plated, two-piece, cast-brass trap and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation
3. Install water led filter Elkay water sentry cartridge type NSF/ANSI 42 / 53 .

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

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3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224217

SECTION 224716 - ELECTRIC WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes electric water coolers and related components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of electric water cooler..

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For electric water coolers to include in maintenance manuals.

1.4 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. Filter Cartridges.

PART 2 - PRODUCTS

2.1 ELECTRIC WATER COOLERS

A. Pressure Water Coolers high-Low ADA/BF lead free wall hung electric water cooler.

1. Standards:

a. Comply with NSF 61 Annex G.
b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

2. Cabinet: Steel with powder-coat finish
3. Bubbler: One, with adjustable stream regulator, located on deck.
4. Control: Push buttons side and front.
5. Drain: Grid with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, wall carrier and adjustable thermostat.

    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. Defined in NFPA 70, by a qualified testing agency, and marked for intended.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

SECTION 230500 – COMMON WORK RESULTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Sleeves.
2. Escutcheons.
3. Mechanical demolition.
4. Equipment installation requirements common to equipment sections.
5. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

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 duct shafts.

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.

1.3 SUBMITTALS

A. None required.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 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.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Refer to Division 01 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Fill abandoned below floor ductwork with flow able fill

3.2 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 mechanical equipment to facilitate service, maintenance, and repair or replacement of components and coils. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.4 ERECTION OF SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical 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

D. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

E. 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. .

END OF SECTION 23 05 00

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Adjusting total HVAC systems to provide indicated quantities.
2. Measuring electrical performance of HVAC equipment.
3. Setting quantitative performance of HVAC equipment.
4. Verifying that automatic control devices are functioning properly.
5. Reporting results of activities and procedures specified in this Section.

B. Scope of Work

1. Air balance rooftop units and furnaces
2. Air balance all supply, exhaust and return diffusers and grilles
3. Exhaust fans

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. AMCA: Air Movement and Control Association.

C. NEBB: National Environmental Balancing Bureau.

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

1.3 SUBMITTALS

A. Certified Testing, Adjusting, and Balancing Reports: Prepared on approved forms certified by the testing, adjusting, and balancing Agent.

1.4 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC or NEBB.

B. Certification of Testing, Adjusting, and Balancing Reports: Certify testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that testing, adjusting, and balancing team complied with approved testing, adjusting, and balancing plan and procedures specified and referenced in this Specification.

C. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing." or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards or NEBB's "Procedural Standards for Testing."

E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner will occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.6 COORDINATION

A. Coordinate efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."

D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

E. Examine system and equipment test reports.

F. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings are properly installed and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

H. Examine equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine equipment for installation and for properly operating safety interlocks and controls.

J. Examine automatic temperature system components to verify the following:
1. Integrity of valves for free and full operation and for tightness of fully closed and fully open positions.
2. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
3. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
4. Sensors are located to sense only intended conditions.
5. Sequence of operation for control modes is according to the Contract Documents.
6. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
7. Interlocked systems are operating.
8. Changeover from heating to cooling mode occurs according to design values.

K. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment access doors are securely closed.
4. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

5. Windows and doors can be closed so design conditions for system operations can be met.

3.3 TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to procedures contained in AABC, NEBB, or SMACNA National Standards and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings..

3.4 REPORTS

A. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

B. Final Report: Typewritten, or computer printout in letter-quality font, on standard bond paper, bound in binder, and tabulated and divided into sections by tested and balanced systems.

1. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing agent.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Final Report Contents: In addition to certified field report data, include the following:

    a. Manufacturers' test data.
    b. Field quality-control test reports prepared by system and equipment installers.
    c. Other information relative to equipment performance, but do not include approved Shop Drawings, system sketches and Product Data.

4. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

    a. Title page.
    b. Name and address of testing, adjusting, and balancing Agent.
    c. Project name.
    d. Project location.
    e. Architect's name and address.
    f. Engineer's name and address.
    g. Contractor's name and address.
    h. Report date.
    i. Signature of testing, adjusting, and balancing Agent who certifies the report.
    j. Summary of contents, including the following:

        1) Design versus final performance.
        2) Notable characteristics of systems.

k. Nomenclature sheets for each item of equipment.
l. Notes to explain why certain final data in the body of reports vary from design values.

3.5 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION 23 05 93

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Outside air intake ductwork to furnaces

1.2 ACTION SUBMITTALS

A. Product Data

B. Shop Drawings

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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 agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation 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. Glass-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, with factory-applied FSK jacket.

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. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; Duct Wrap.

2.2 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. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

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1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inchin width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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 (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 **inches** o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. 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.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. .

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 INSTALLATION OF FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

7. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches

8. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches.

3.5 DUCT INSULATION SCHEDULE, GENERAL

A. Ducts Requiring Insulation:

1. Outside air intake ductwork to furnaces

3.6 INDOOR DUCT INSULATION SCHEDULE

A. Insulate OA intake air ductwork with 1” duct wrap FSK

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping system
2. Refrigerant suction and hot-gas piping system, indoors and outdoors

B. Related Sections:

1. Division 23 Section "HVAC Equipment Insulation."
2. Division 23 Section "Duct Insulation."

1.3 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. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 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.

1.4 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.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping 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.

1.6 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

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation 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. Insulate piping system with fiberglass insulation with ASJ

F. Wrap insulated piping outdoors with aluminum or PVC jacket sealed water tight

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

2.3 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. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.
5. .

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.

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 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm (0.013 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
    a. >.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209 , Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Underground Direct-Buried Jacket: 125-mil thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches

2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lb/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lb/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 0.015 inch thick,.
2. Aluminum: ASTM B 209 , Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/**2 inch w**ide
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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems 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.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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, mastics, 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 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, 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.

3.4 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 (50 mm) 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" for 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."

3.5 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. Stencil or 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 gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, 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 (50 mm) 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.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, 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 cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), 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. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

E. 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..

3.7 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.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 1/2 inch

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B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches

3.9 OUTDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 2 inches thick.
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3.10 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Loose-fill insulation, for belowground piping,.

3.11 INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230719

SECTION 230900 - TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.2 ACTION SUBMITTALS

A. Product Data: For each control device indicated.

B. Shop Drawings:

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Details of control panel faces.
4. Damper schedule.
5. Valve schedule.
6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
7. Control System Software: Schematic diagrams, written descriptions, and points list.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Software and firmware operational documentation.

1.5 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

2.2 CONTROL SYSTEM

A. Control system for the VRF heat pump system to be furnished by equipment manufacturer / supplier, wired and installed by mechanical contractor.

B. Provide control system for air compressor room ventilation including Belimo damper operators, wiring, conduits, thermostat etc.,

C. Provide controls for Apparatus bay ventilation / gas monitoring system, Belimo damper operators, conduits, wiring etc.

2.3 CONTROL CABLE

A. As recommended by equipment manufacturer / supplier

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

B. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.

C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

D. Install labels and nameplates to identify control components

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.

5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check DDC system as follows:

    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 230900

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

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.

1.4 PERFORMANCE REQUIREMENTS

A. Natural-Gas System Pressure within Buildings: 7”- 11” WC

B. Natural-Gas System Pressure to emergency generator: 7”- 11” WC

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. 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.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

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1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
    b. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Operating-Pressure Rating: 0.5 psig .
5. End Fittings: Zinc-coated steel.
6. Threaded Ends: Comply with ASME B1.20.1.
7. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: **125 psig.**
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig .
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
5. .

D. Cast-Iron, Non-lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig .
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.

8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
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B. Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator vent connection piped to out doors

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig
c. End Connections: Solder-joint copper alloy and threaded ferrous.

B. Dielectric Flanges:

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1. Description:

    a. Standard: ASSE 1079.
    b. Factory-fabricated, bolted, companion-flange assembly.
    c. Pressure Rating: 125 psig
    d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

C. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 5and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 18 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit below sidewalks and paved road ways

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

C. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. 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.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. 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.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches minimum rod size, 3/8 inch

2. NPS 1-1/4 : Maximum span, 108 inches minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2 : Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet ; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet ; minimum rod size, 5/8 inch .

D. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8 : Maximum span, 48 inches ; minimum rod size, 3/8 inch .
2. NPS 1/2 and NPS 5/8 : Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and NPS 7/8 : Maximum span, 84 inches minimum rod size, 3/8 inch
4. NPS 1 : Maximum span, 96 inches ; minimum rod size, 3/8 inch .

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel.
d. Color: yellow with black letters “NG”

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex
d. Color: yellow with black letter “NG”

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.13 PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
3. Annealed-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

B. Aboveground natural-gas piping shall be the following:

1. Schedule 40 Steel pipe with malleable-iron fittings and threaded joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

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END OF SECTION 231123

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig .
3. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

A. Shop Drawings: VRF system equipment manufacturer / supplier to furnish complete installation drawings showing the entire layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only and issued for reference only

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.8 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.9 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig .
7. Maximum Operating Temperature: 275 deg F .

B. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig .

C. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig .
6. Maximum Operating Temperature: 240 deg F .
7. >.

D. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig .
5. Maximum Operating Temperature: 275 deg F
6.

2.3 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines and Suction Lines for Heat-Pump Applications: Copper, Type ACR annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Safety-Relief-Valve Discharge Piping: Copper, Type ACR annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

3.3 PIPING INSTALLATION

A. 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 Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

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 adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.

3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel 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.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal run 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches minimum rod size, 1/4 inch .
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch .
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch .
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch .
5. NPS 1-1/2: Maximum span, 96 inches minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches ; minimum rod size, 3/8 inch

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig .
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Division 23 Section 23 07 13 “Duct insulation” for duct wrap

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. WORKING DRAWINGS:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.

9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. All exterior supply and return air ductwork to be sealed water tight and protected from corrosion.

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-

pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg , positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.6 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.

2. Maximum Thermal Conductivity:
   1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   3) Minimum thickness and rating shall comply with ASHRAE 90.1-2007 table 6.8.2B.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

B.

1. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
   a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Insulation Pins and Washers:
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.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
   1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
   2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
   3. Butt transverse joints without gaps, and coat joint with adhesive.
   4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
   5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
   6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm
   7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
   8. Secure transversely oriented liner edges facing the airstream with metal nosing's that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
      a. Fan discharges.
      b. Intervals of lined duct preceding unlined duct.
      c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
   9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
      a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
   10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than2-Inch wg Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean duct systems before testing, adjusting, and balancing.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Supply Ducts:

1. Ducts Connected to Rooftop Units :

a. Pressure Class: Positive 2-inch wg .
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

B. Return Ducts:

1. Ducts Connected to Rooftop Units:

a. Pressure Class: Positive or negative 2-inch.
b. Minimum SMACNA Seal Class: A
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: [12] [24] <Insert value>.
d. SMACNA Leakage Class for Round and Flat Oval: [6] [12] [24] <Insert value>.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.].

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm :

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

G. DUCT LINER INSULATION THICKNESS

General: Comply with ASHRAE 90.1-2007 standards

Furnaces:

1. All supply air ductwork 1" thick R-3.5
2. All return air ductwork 1" thick R-3.5 in mechanical room and 10"0" minimum beyond
3. Outside air intake ductwork to have 1" fiberglass duct wrap

Rooftop unit:

1. Supply and return air ductwork outside the building and in the chase: 1 1/2" thick R-6 minimum
2. Supply air inside the building 1" thick R-3.5
3. Return air ductwork 1" thick R 3.5

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Turning vanes.
3. Remote damper operators.
4. Duct-mounted access doors.
5. Flexible connectors.
6. Flexible ducts

B. Related Requirements:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).

2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Air Balance Inc.; a division of Mestek, Inc.
   b. McGill AirFlow LLC.
   c. Nailor Industries Inc.
   d. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

   a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.5 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded mechanically attached corners and mounting flange.

F. Heat-Responsive Device: Resettable, 165 deg F rated, fire-closure device.

G. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.

H. Blades: Roll-formed, horizontal, interlocking, 0.063-inch-thick, galvanized sheet steel.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.05-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

L. Damper Motors: two-position action.

M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Electrical Connection: 115 V, single phase, 60 Hz.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts:

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Flexmaster U.S.A., Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Ventfabrics, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
d. Fabricate doors airtight and suitable for duct pressure class.

2.8 FLEXIBLE CONNECTORS

A. of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.9 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.11 KITCHEN HOOD

A. Furnish and install a SS kitchen hood in kitchen 151

B. Hood shall be heavy-duty stainless steel construction, 36" wide with SS baffle type grease filters, SS back splash, roof vent, built-in light, speed switch, exhaust fan and blower controls and light switches.

C. Ductwork shall be heavy gauge sealed water tight ducted up to vent on roof and insulated with fire wrap

D. Based on Broan / Nutone Series RM 60000 model RM325H with fan rated for 600 cfm

E. Approved manufacturers:
1. Broan/Nutone
2. Greenheck

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel. Some volume dampers are indicated on the drawings. Coordinate with the TAB contractor and provide additional dampers as necessary to complete TAB as indicated.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

I. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. Connect diffusers with maximum 60-inch lengths of flexible duct clamped or strapped in place.

L. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.

END OF SECTION 233300

SECTION 23 37 13 – DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to Division 00, Bidding and Contract Requirements, and to Division 01, General Requirements, which are hereby made a part of this Section.

1.2 DESCRIPTION OF WORK

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of equipment specified under this section include the following:

1. Supply, return and exhaust grilles and diffusers

C. Refer to section 23 31 13 for “metal duct” and 23 33 00 for “duct accessories” required in conjunction with air outlets and inlets.

D. Refer to - sections 23 05 93 for “Testing, adjusting and balancing for HVAC” .

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets."
2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets."
3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual."
4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
5. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for all equipment, VAV boxes, reheat coils, diffusers and grilles.

B. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals in accordance with requirements of Division 1.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 SUPPLY, RETURN AND EXHAUST GRILLES AND DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard grilles, registers, and diffusers where shown; of size, shape, capacity and type scheduled; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling grilles, registers, and diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide ceiling grilles, registers, and diffusers with border styles that are compatible with adjacent ceiling systems and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to reflected ceiling plans and specifications for types of ceiling systems which will contain each type of ceiling grille, register, or diffuser.

D. Types: Provide floor and ceiling grilles, registers, and diffusers of type, capacity, and with accessories and finishes as listed in the schedule on the drawings.

E. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following or equal:

1. Krueger Mfg. Co.
2. Titus Products Div.; Philips Industries, Inc.
3. Tuttle and Bailey
4. Price

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans."

D. Coordinate frame type with Architectural reflected ceiling plan.

END OF SECTION 23 37 13

SECTION 235400 - FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Gas-fired, condensing furnaces and accessories complete with controls.
2. Air filters.
3. Refrigeration components, piping
4. DX coil
5. Filters
6. Programmable thermostat

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:

1. Furnace.
2. Thermostat.
3. Refrigeration components.
4. Condensing unit

1.3 INFORMATIONAL SUBMITTALS

A. Warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period

PART 2 - PRODUCTS

2.1 GAS-FIRED FURNACES, CONDENSING

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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide product name or a comparable product by one of the following:
1. Carrier Corporation; Div. of United Technologies Corp.
2. Goodman Manufacturing Company, L.P.
3. Lennox Industries Inc.
4. Rheem Manufacturing Company; Air Conditioning Division.
5. Ruud Air Conditioning Division.
6. Trane.
7. York International Corp.; a division of Unitary Products Group.

D. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.

E. Cabinet: steel

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

F. Fan: Centrifugal, factory balanced, resilient mounted, direct drive,
1. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

G. Type of Gas: Natural

H. Heat Exchanger:

1. Primary: Aluminized or Stainless steel.
2. Secondary: Stainless steel.

I. Burner:

1. Gas Valve: 100 percent safety modulating main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

J. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

K. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings pre-purges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

L. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories diagnostic light with viewport

M. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof
2. CPVC Plastic Vent Materials.

a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.
b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
c. CPVC Solvent Cement: ASTM F 493.

1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. PVC Plastic Vent Materials:

a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
c. PVC Solvent Cement: ASTM D 2564.

1) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 THERMOSTATs

A. Controls shall comply with requirements in ASHRAE/IESNA 90.1, "Controls."

B. Solid-State Thermostat: Wall-mounting, programmable, microprocessor-based unit with automatic & manual switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.

C. Control Wiring: Unshielded twisted-pair cabling.

1. No. 24 AWG, 100 ohm, four pair.
2. Cable Jacket Color: Blue

2.3 AIR FILTERS

A. Disposable Filters: Merv 8 pleated fiberglass media in frame.

2.4 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Refrigeration compressor coils, and specialties shall be designed to operate with CFC-free refrigerants.
2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."

B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet.

1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1 inch thick. Insulation outdoors to be painted and covered with aluminum jacket

D. Refrigerant Piping: Comply with requirements in Division 23 Section "Refrigerant Piping."

E. Air-Cooled, Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed reciprocating or scroll type.

a. Crankcase heater.
b. Vibration isolation mounts for compressor.
c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
e. Refrigerant: R-407C or R-410A.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Base-Mounted Units: Provide 4” thick pre-fabricated base for each furnace. Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

C. Controls: Install thermostats at mounting height of 48 inches above floor.

D. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

E. Install ground-mounted, compressor-condenser components on 4-inch- thick, concrete base; 4 inches larger on each side than unit. Coordinate anchor installation with concrete base.

3.2 CONNECTIONS

A. Gas piping installation requirements are specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
c. 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.
d. Requirements for Low-Emitting Materials:

1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

4. Slope pipe vent back to furnace or to outside terminal.

D. Connect ducts to furnace with flexible connector. Comply with requirements in Division 23 Section "Air Duct Accessories."

E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.

1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
2. 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.
3. 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. Comply with requirements in Division 23 Section "Refrigerant Piping" for installation and joint construction of refrigerant piping.

G. Complete installation and startup checks and start units according to manufacturer's written instructions.

H. Verify proper operation of capacity control device.

I. Adjust airflow and initial temperature and humidity set points.

J. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

K. After completing installation, clean furnaces internally according to manufacturer's written instructions.

L. Install new filters in each furnace within 14 days after Substantial Completion.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 235400

SECTION 23 7413 - PACKAGED GAS/ELECTRIC ROOFTOP UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, outdoor, rooftop units with the following components and accessories:

1. Direct-expansion cooling.
2. Gas furnace.
3. Economizer relief, outdoor- and return-air damper section.
4. Roof curb
5. Merv 8 filters
6. Programmable thermostat
7. Smoke detector

1.2 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.3 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

B. Warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.

2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigerant system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. 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.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fails in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than **five** years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Carrier Corporation.
2. Trane; American Standard Companies, Inc.
3. Johnson / YORK International Corporation.
4. Daikin

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

C. Inner Casing Fabrication Requirements:

1. Inside Casing: Duct liner and perforated steel cover.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 2 inch.
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: IAQ Formed sections of stainless-steel sheet, a minimum of 2 inches deep and complying with ASHRAE 62.1.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 FANS

A. Direct-Driven Supply-Air Fans: Double width, forward curved or backward inclined, centrifugal; with permanently lubricated, motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

D. Relief-Air 100% barometric, adjustable SP control.

E. Fan Motor high efficiency

2.4 COILS

A. Refrigerant Coil:

1. Copper-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.
4. Condensate Drain Pan: IAQ Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.

B. Compressor scroll mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief and crankcase heater.

C. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.

2.6 AIR FILTRATION

A. Minimum Arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value MERV8 (40%) according to ASHRAE 52.2.

2.7 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented.

E. Safety Controls:

1. Gas Control Valve: Single stage or two stage.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 DAMPERS

A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

1. Damper Motor: Modulating with adjustable minimum position.

2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Control equipment and sequence of operation

B. Basic Unit Controls:

C. Controller:

1. Programmable Thermostat.
2. Safety Control Operation:

    a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected.

3. Scheduled Operation: Occupied and unoccupied periods.

4. Supply Fan Operation:

    a. Occupied Periods: Run fan continuously.
    b. Unoccupied Periods: Cycle fan to maintain setback temperature.

5. Refrigerant Circuit Operation:

    a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain room or discharge air temperature. Cycle condenser fans to maintain maximum hot-gas pressure.
    b. Unoccupied Periods: Compressors off.

6. Gas Furnace Operation:

    a. Occupied Periods: Stage burner to maintain room or discharge air temperature.
    b. Unoccupied Periods: Cycle burner to maintain setback temperature.

7. Economizer Outdoor-Air Damper Operation:

    a. Occupied Periods: Open to **10** percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than **60 deg F**. Use mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. During economizer cycle operation, lock out cooling.
    b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

2.11 ACCESSORIES

A. Filters

B. Hail guards of galvanized steel, painted to match casing.

2.12 ROOF CURBS

A. Roof curbs

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or II.
b. Thickness: 2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: 14 inches.

2.13 CAPACITIES AND CHARACTERISTICS

A. See schedule on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof Curb: Install on concrete pad level and secure,

B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

C. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

D. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.

2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors.
4. Install return-air duct continuously through roof structure.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.3 CLEANING AND ADJUSTING

A. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

END OF SECTION 23 7413

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Divisions 26, 27 and 28 Sections, in addition to Division 1 - General Requirements.

1.2 WORK BY OWNER

A. Specifically this work includes:

1. "Package Unit" equipment and similar items will be furnished by the Owner. Electrical Trades shall make incoming line power connections and/or provide disconnect switch or starter, as required.

1.3 WORK SEQUENCE

A. Install work to accommodate Owner's occupancy requirements during the construction period, coordinate electrical schedule and operations with Architect/Engineer.

1.4 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code, Current Edition.

1.5 SUBMITTALS

A. Submit under provisions of Section 01700.

B. Proposed Products List: Include Products specified in the following sections:

1. Section 260500 – Common Work Results for Electrical
2. Section 260519 – Low-Voltage Electrical Power Conductors and Cables
3. Section 260526 – Grounding and Bonding for Electrical Systems
4. Section 260529 – Hangers and Supports for Electrical Systems
5. Section 260533 – Raceways and Boxes for Electrical Systems
6. Section 260544 – Sleeves and Sleeve Seals for Electrical Raceways and Cabling
7. Section 260553 – Identification for Electrical Systems
8. Section 262417 – Panelboards
9. Section 262726 – Wiring Devices
10. Section 262813 – Fuses
11. Section 262816 - Enclosed Switches
12. Section 262913 – Enclosed Controllers
13. Section 265100 – Lighting
14. Section 265200 - Lighting Control System
15. Section 266000– Mounting Heights of Equipment

16. Section 266001 – Acceptance Testing
17. Section 270527 – Pathways for Communications Systems
18. Section 270528 – Voice and Data Communications System
19. Section 270529 – Telecommunications System
20. Section 271300 – Control/Signal Transmission Media
21. Section 275117 – Audio Visual System
22. Section 280513 – Conductors and Cables for Electronic Safety and Security

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in separate submittals by system.

D. Mark dimensions and values in units to match those specified.

1.6 REGULATORY REQUIREMENTS

A. All applicable ADA, County and City codes and ordinances.

B. Request inspections from authority having jurisdiction.

C. All work shall be performed or installed in strict accordance with all applicable rules, regulations, and codes of Local, State and Federal Governments, or other authorities having lawful jurisdiction, and each Contractor and Subcontractor shall be responsible for such compliance.

D. All electrical work and equipment shall conform to the requirements of the current issue of the National Electrical Code, and shall bear the label of listing with the Underwriter's Laboratories.

E. Contractor shall cooperate with and assist other Contractors and subcontractors on the job in conformity with all current trade jurisdictional rulings. He shall perform all work covered by the drawings and specifications which properly comes under the jurisdiction of the trade he represents, and shall include such work of other trades as is incidental to his work, or is specified to be included in his contract. Where jurisdictional rules require the assistance of mechanics of his trade, in the handling of equipment furnished by others, or in the work of other trades, Contractor shall provide such assistance.

F. Where quantities or sizes or other requirements of the drawings or specifications are in excess of applicable code requirements, the contractor shall comply with the drawings or specifications.

G. The following codes and standards are hereby incorporated by reference and made a part of this specification:

1. Applicable Federal, State and local codes, ordinances and regulations, which also shall govern over NEC should a conflict exist.
2. NEC, (National Electrical Code), latest edition as approved by the local authority having jurisdiction.
3. NEMA, (National Electrical Manufacturers Association) standards, latest revisions.
4. IEEE, (Institute of Electrical and Electronics Engineers) standards, latest revisions.
5. ANSI, (American National Standards Institute), latest revisions.
6. IPCEA, (Insulated Power Cable Engineers Association) standards, latest revisions.
7. ASTM, (American Society for Testing of Materials), latest revisions.
8. EPA, (U.S. Environmental Protection Agency), latest revisions.
9. NES, (National Emission Standards for Hazardous Air Pollutants)
10. MDPH, (Michigan Department of Public Health Regulations), latest revisions.
11. UL, (Underwriter's Laboratories, Inc.) equipment and materials shall bear the "UL" label where labeling service is regularly furnished.
12. NFPA, (National Fire Prevention Association), latest editions of applicable documents.
13. OSHA, (U.S. Occupational Safety and Health Act), latest revisions.

1.7 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.8 SEQUENCING AND SCHEDULING

A. Construct work in sequence of schedule developed by Owner/Architect.

1.9 WIRING METHODS

A. Provide raceways for all wiring. Wiring shall not be run exposed or concealed without being enclosed in raceways unless otherwise noted.

B. Do not mix wiring systems. Provide separate raceways for different systems by Voltage, type, or purpose.

1. 120 volt separate from 208 volts.
2. Lighting separate from power.
3. Audio visual system separate.
4. Emergency egress lighting separate
5. Telephone/data system separate.

1.10 ELECTRICAL WORK - GENERAL DESCRIPTION

A. Electrical work for the project will include, but not necessarily be limited to the following:

1. The provision of electrical equipment, including receptacles, conduit, wiring, starters, disconnect switches, etc. for mechanical equipment.
2. The provision of lighting, receptacles, and associated branch circuits.
3. The provision of voice/data system, including raceways, wiring, jacks, outlets and grounding as indicated and required.
4. The provision of all lighting fixtures including lighting contactors, photocells, switches, cover plates, lamps, occupancy sensors, conduit, wiring, etc. as indicated and required.
5. The provision of all associated ground cables and connections as required.
6. The provision of lighting and receptacle panels including feeders and associated circuit breakers, conduit, wiring, branch circuits, and associated main circuit breakers where applicable.
7. All items incidental to and/or required for a complete installation.
8. The provision of all electrical service distribution equipment, including electrical wireway, panels, conduit, wiring, etc. as indicated and required.
9. All cutting and patching required for the installation of electrical work.
10. All supports required for the installation of electrical equipment, conduits, raceways, boxes, light fixtures, etc. as required for proper installation.
11. All grounding, as indicated and per applicable code requirements.
12. The provision of all exit and emergency lights as indicated and required.
13. The provision of all receptacles, coverplates, junction boxes, etc. as indicated and required.
14. The provision of an audio/visual system for meeting room including conduit, wiring, speakers, microphones, amplifier, televisions, outlets, etc. as indicated and required.

B. The Contractor shall provide all items, articles, materials, operations, or methods mentioned, listed, or scheduled on the drawings and in these specifications, including all labor, materials, equipment, and all incidentals necessary required for the completion and operation of all systems.

C. The installation shall be made so that all component parts function together as a workable system; it shall be complete with all accessories necessary for proper operation. When the installation is complete, all equipment shall be operative and in proper adjustment. All work shall be executed in conformity with the best practice so as to contribute to efficiency of operation, minimum maintenance, accessibility, and sightliness.

D. To accomplish these results, the Contractor shall consult the Architects and Engineers plans covering the other trades, the field layouts of the contractors for these trades and their shop drawings. He shall coordinate his work accordingly.

1.11 RELATED WORK SPECIFIED ELSEWHERE

A. The Contractor shall consult the Architect's drawings and specifications regarding items of special equipment which are to be connected by him.

B. He shall also consult the mechanical trades' drawings and specifications of mechanical equipment and temperature controls and shall coordinate this work accordingly.

1.12 LOCAL CONDITIONS

A. The Contractor shall visit the site and shall familiarize himself with conditions which will affect the work he is to perform. The submission of a proposal by this Contractor shall be conclusive evidence that this Contractor has visited the site and has given proper consideration and evaluation of these conditions in the preparation of his proposal. No allowance shall subsequently be made in his behalf for extra expense incurred due to failure or neglect on his part to make this visit and examination.

B. Where active sewers, gas, electric, or other services are encountered during the performance of this contract, the Contractor shall protect, brace, and support them as required. Do not prevent, interrupt, or disturb operation of existing services that are to remain. Relocate existing services if required.

1.13 PERMITS AND INSPECTIONS

A. The Contractor shall take out all permits required and arrange for all necessary inspections and shall pay for all fees and expenses in connection therewith as a part of their work under their Contract.

B. Upon completion of the work, they shall furnish to the Owner all certificates of inspection and approval which are customary for the classes of work involved.

1.14 EQUIPMENT SUBSTITUTIONS

A. The name or make of any article, device, materials, form of construction, fixture, etc., named in this specification, whether or not the words "or approved equal" are used shall be known as a "standard".

B. Where two or more standards are named together, bidder shall base his proposal upon any one of the standards and shall list his standard in the space provided on his proposal form. If the bidder fails to name a selected standard, it shall be assumed he is consenting to have the Owner make a selection.

C. Bidders may submit for consideration substitutions for the standards specified, provided:

1. They name the substitute bid on, and the addition or deductions they will make to or from their bid, provided such substitute is approved by the Engineer.
2. Complete specifications and descriptions of the substitutes bid upon shall be furnished the Engineer prior to the award of the contract.

D. If the bidder names no substitute, the standards specified shall be used. No substitutes will be allowed after the award of the Contract, except with the approval of the Engineer.

E. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawing, which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign and all new drawings and detailing required therefore, shall be prepared by the Contractor at his own expense.

F. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring, conduit, etc., and any other additional equipment required by the system, at no additional cost to the Owner.

1.15 MINOR DEVIATIONS

A. The dimensions and ratings of equipment herein specified or indicated on the drawings are intended to establish the desired outlines and characteristics of such equipment. Minor deviations will be permitted to allow manufacturers specified to bid on their nearest stock equipment.

B. Manufacturers catalog or model number and types mentioned in the specifications or indicated on the drawings are intended to be used as guides and shall not be interpreted as taking precedence over specific ratings or duty called for or shown, which modify stipulations in such catalogs. In all cases the manufacturer shall verify the duty specified with the particular characteristics of the equipment he intends to offer for approval, and shall offer only items which comply with Specifications requirements.

1.16 DEFINITIONS

A. Where the words "Mechanical" or "Electrical" or "Mechanical or Electrical Work" appear in any of the contract documents, they shall be taken to mean or refer to the sections of the specifications for plumbing, heating, ventilating or other mechanical work and for electrical work.

1.17 EXTRA WORK

A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done.

1.18 DRAWINGS AND MEASUREMENTS

A. These specifications and accompanying drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either shall be as binding as if called for by both. The Contractor will understand that the work herein described shall be complete in every detail.

B. The drawings are not intended to be scaled for rough-in measurements or to serve as shop drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor. The Contractor shall check latest architectural drawings and locate light switches from same where door swings are different from electrical drawings.

C. Where job conditions require reasonable changes in indicated locations and arrangement, such changes shall be made without extra cost to the Owner, if requested before work is installed.

D. The drawings show the general design and location of equipment. The drawings are to be considered diagrammatic and are not intended to be scaled for roughing-in measurements, or to serve as shop drawings.

E. Electrical work is shown on drawings by standard symbols. Special symbols, if used, are shown in a legend on drawings.

F. Outlets connected by lines show switch control or circuiting only and are not actual runs of conductors. All light and receptacle outlets are lettered and numbered; the letter indicates the panel from which the circuit is to be controlled. All outlets bearing the same letter and number shall be connected to the same circuit.

G. Follow the drawings in laying out the work. Consult architectural, structural, and mechanical construction documents to become familiar with all conditions affecting the work, and verify all spaces in which work will be installed. Field measurements shall be taken where necessary, for ordering materials and fitting the installation to the building construction.

1.19 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Responsibility for care and protection of electrical work rests with the Contractor until it has been tested and accepted.

B. After delivery, before and after installation, protect equipment and materials against theft, injury, or damage from all causes.

C. Protect equipment outlets, pipe and conduit openings, etc., with temporary plugs, caps, or burlap.

D. Each Contractor shall receive, properly house, handle, hoist, and deliver to proper location, equipment and other material required for this contract.

E. Protect lighting fixtures and other equipment, with finished enamel or glazed surfaces, from damage by covering and/or coating as approved or directed by the Owner’s representative.

1.20 SCHEDULE OF WORK

A. The Contractor shall expedite his work in order to conform to the dates outlined in the General Contractor's progress schedule and where necessary shall work overtime at his own expense so that all work may be completed within the time outlined. See Section 013213 for additional scheduling requirements.

1.21 CUTTING AND PATCHING

A. The Contractor shall "build in" his work and shall be responsible for holding his work in place while concrete is being poured and while walls are being laid. He shall have competent men available at all times to see that his work is well in advance of the mason contractor and that his work is coordinated with the other trades.

B. Any and all cutting of the building made necessary by the improper location of this work, or by the failure to build such work into the structure, shall be done at the expense of the Contractor.

C. No cutting or burning of holes through beams or other structural members shall be done without the specific permission of the Architect.

D. All openings in walls, ceilings, or floors made by the Contractor shall be neatly patched by him after other work is done.

E. All measurements necessary for the proper installation of materials or apparatus shall be taken in the field. The Contractor will be held responsible for the correct fit of work installed.

F. Refer to General Conditions for cutting, patching and refinishing work necessary for the installation of electrical work.

1.22 DAMAGE TO OTHER WORK

A. The Contractor will be held responsible for all damage to the work installed by others that may be caused by his work or by anyone employed by him. Patching and replacing of damaged work will be done by the trade whose work was damaged and as directed by the Architect, but the cost of same shall be paid by the Contractor.

1.23 TESTS AND ADJUSTMENTS

A. All electrical circuits shall be tested as soon as conductors are installed, and final tests shall be made in presence of Engineers, when all work is complete, if required. If circuits are not properly controlled and insulated, make necessary changes and repairs. All electric motors shall be checked for proper rotation.

B. When the systems are completed, the Contractor shall operate equipment as directed by the Owner's Representative. Replace all faulty equipment. Make necessary adjustments before final acceptance.

C. Perform all tests required by State, City, County and/or other agencies having jurisdiction.

D. Provide all materials, equipment, etc., and labor required for tests.

E. Provide complete operating instructions, manuals and repair parts lists for the Owner's personnel as specified above. Instruct Owner's personnel in the operation of all systems.

1.24 "AS-BUILT" CONDUIT DRAWINGS

A. The Contractor shall keep in its field office, one copy of all drawings, specifications, shop drawings, and changes available for reference by the Owner and Architect, reflecting an accurate and up-to-date record of actual construction whether or not covered by official revisions to drawings and specifications.

B. As-built drawings shall consist of separate plans for lighting systems, power systems, special signal systems, riser diagram, etc. Each system drawing shall show location, size and conductor fill for all conduits, junction boxes, and outlets.

C. At completion, the Contractor shall furnish to the Owner one (1) complete set of drawings, neatly marked and dimensioned where required to show all variations between actual construction as built and work as indicated on the printed drawings, including all changes in locations, sizes, depth, elevations, etc. Particular care shall be taken to fully dimension all concealed work performed under the Contract. These drawings shall be new sets purchased from the Architect, each sheet certified as built by the Contractor, and turned over to the Owner in good condition.

D. The layout shop drawings as hereinbefore described shall be revised as required during construction to indicate the as-built condition.

1.25 COORDINATION

A. Contractor shall cooperate with all other Contractors and Subcontractors performing work on this project as necessary to achieve a complete neatly fitted installation for each condition. To that end, Contractor shall consult the drawings and specifications for all trades to determine nature and extent of work specified in other Sections which adjoins or attaches to his work to which his work attaches or joins. Cost of repairs or alterations of work in place made necessary by failure to observe this requirement shall be paid for by Contractor so failing. (See also Articles above and provisions of GENERAL CONDITIONS concerning jurisdictions.)

B. Contractor shall confer with other Contractors and Subcontractors at the site to coordinate his work with theirs in view of job conditions to the end that interferences may be eliminated and that maximum head room and clearance may be obtained. In the event that interferences develop, the Architect's decision will be final as to which trade shall relocate its work, and no additional compensation will be allowed for the moving of piping, ductwork, conduit, or equipment to clear such interferences.

C. Where bulky equipment cannot be delivered or installed without unduly delaying concrete or masonry work, Contractor shall arrange for leaving openings in floors, walls, or roofs as necessary for ingress thereof. He also shall arrange for the subsequent closing of the openings. Arrangements for and closures of the openings shall be subject to Architect's approval and all costs therefore shall be paid by Contractor requiring such provisions.

1.26 GUARANTEE AND WARRANTY

A. Contractor shall guarantee all work installed by him or his Subcontractors to be free from defect in material and workmanship for a period of one year following the date of final acceptance of the work, unless a longer period is stipulated under specific headings, and he shall repair or replace at no additional cost to the Owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional twelve (12) month’s guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers.

B. Contractor shall submit his own and each equipment manufacturer's written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications.

C. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

D. Also refer to the GENERAL CONDITIONS for additional guarantee requirements.

1.27 STENCILING

A. All panels, disconnect switches, starters and switches shall have the name of the machine controlled and/or feeder designation stenciled on front cover in one inch letters with black stencil paint.

1.28 TEMPORARY LIGHT AND POWER

A. The Contractor shall provide, install, and maintain all facilities required for temporary lighting and power as hereinafter specified. At completion of project, contractor shall remove all temporary lighting and power items.

B. Contractor shall use existing 200A-120/240V, single phase, three wire service to site including underground wiring, panel and power pole, which shall be utilized.

C. Contractor shall provide lights and lamps to maintain temporary lighting required.

D. Other Contractors using this temporary service shall provide their own extension cords and any required additional lamps.

E. Install weatherproof outlets, one for 150 watts of lighting and one for 200 watts of power, uniformly spaced in new addition not exceeding 50’ on center and also one of each in every 800 square feet of larger rooms. Also provide a 120/240 volt, 30 amp, single phase, three wire outlet centrally located in building.

F. If additional power or wiring is required, Contractor requiring same shall pay the Contractor for providing this service.

G. Cost of current consumed will be paid by the Owner.

H. The Contractor shall also provide temporary wiring and connections for fan motors, pumps, fuel burners, etc., at the direction of the Architect, when heat or ventilation is required during the construction of the remodeled areas.

I. The Contractor shall perform his work in accordance with any applicable safety laws, rules, or regulations of the State of Michigan.

1.29 QUALITY OF WORKMANSHIP

A. Execute the work required in a manner evidenced by the "best trade practices" contributing to efficiency of operation, minimum maintenance, accessibility and aesthetics of the installation.

B. Equipment and materials, unless noted otherwise, shall be new and shall conform to the requirements of standard specifications and tests of organizations as listed in this division and in the requirements noted in other sections of Divisions 26, 27 and 28.

1.30 INSERTS, SLEEVES, OPENINGS, HANGERS, ETC.

A. Furnish to the General Contractor before pouring of concrete or laying of masonry, all inserts, sleeves, openings, hangers, etc., in the walls, floors, ceilings or roof necessary to complete the work, including setting or location diagrams.

B. Provide fire stops for all electrical openings in fire rated surfaces. Seal space between sleeves and conduit with approved fireproofing material. Integrity of system shall be maintained to the rating of the item pierced.

C. Provide conduit sleeves where conduits pass through poured-in-place concrete floors, walls, beams, and ceilings. Sleeves shall be galvanized rigid steel conduit. Aluminum conduit shall not be used. Where specific sizes are not indicated on drawings, sleeves shall be sized to provide one-half (1/2) inch clearance around the outside surface of the item for which they were installed. They shall be flush with wall surfaces, and shall extend one inch, or as directed, above finished floor levels. The space between conduit and sleeves shall be packed with fiberglass or other approved non-combustible packing material to prevent passage of air, liquid, or fumes from one area to another.

D. The filler materials used shall be rated at least equal to the fire resistance of the construction material being penetrated.

E. Provide flashings and construct roof openings to meet the requirements of the roofing manufacturer.

1.31 PAINTING

A. Touch-up paint manufacturer's finishes on electrical equipment marred during shipment, construction, or installation.

B. Prime paint all bare metal electrical equipment, supports, platforms, etc., with two coats of an approved oil base paint. Color of paint shall be selected such that it blends with surroundings.

C. Fronts of all flush cabinets shall have primary coat only. Finishing coats will be by others.

D. All factory finished electrical equipment shall be cleaned at completion of the job. Equipment showing rust or mars shall be touched up with enamel of color to match original finish.

E. All exposed conduit installed in unfinished rooms such as electrical rooms, etc. shall be painted by the Contractor. Color to blend in with color scheme.

1.32 EQUIPMENT IDENTIFICATION

A. All conductors shall bear identification as to size and type of insulation, and shall be equipped with wire markers indicating the circuit number, wire number and/or phase letter.

B. Identify electrical equipment with the name of the equipment, the equipment controlled or the system involved.

C. On all surfaces less than 4" x 4", identification shall be made by means of raised letters and figures on an aluminum strip with a pressure sensitive adhesive.

D. On surfaces 4" x 4" and larger, in unfinished areas such as electrical room, identification shall be made by means of stenciling with bright yellow paint, or a good quality decal.

E. Panels shall have nameplates designating their name and voltage such as LP-C, 120/208 volts, 3ø, 4W.

F. The nameplates shall be black laminated plastic with white characters. The characters on the nameplates shall be 1/4" high, unless otherwise directed in the field. The characters shall be engraved on the nameplates with nomenclature as shown on the drawings or as directed by the Architect/Engineer.

G. Any stenciling shall be done only after the general painting of the building interiors, etc., is completed.

H. Disconnect switches and starters shall have nameplates to indicate the circuit and panel from which the service originates, and the equipment which it controls.

1.33 DEMONSTRATION

A. Instruct the Owner in the care, operation, and maintenance schedule of all apparatus and equipment for a minimum of four (4) hours.

B. Each piece of equipment shall be provided with three (3) sets of printed operating and service instructions. Instructions shall include a list of all items requiring periodic servicing and their frequencies, together with a checklist and recommendations for establishing a system of preventative maintenance for each item of equipment and each system. Instructions shall be bound in 3-ring binders and delivered to the Owner before final acceptance of this work.

C. Control diagrams for all equipment or systems that are automatically controlled or operated shall be framed and faced with permanent type transparent material. Diagrams shall be posted in the equipment rooms adjacent to the equipment controlled.

D. All electrical equipment shall be operated by the Contractor for a period of 60 days minimum under normal building use before final acceptance by the Owner, during which time all repairs and adjustments shall be made by the Contractor prior to the commencement of the guarantee period.

1.34 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof, for purposes other than testing, even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor shall it be construed to obligate the Owner in any way to accept improper work or defective materials.

1.35 EQUIPMENT CONNECTIONS

A. Connections to equipment, motors, fixtures, etc., shall be made in accordance with the shop drawings and rough-in measurements furnished by the manufacturer of the particular equipment furnished. Any and all additional connections not shown on the plans but called for by the electrical shop drawings or required for the successful operation of the particular equipment furnished, shall be installed as part of this Contract at no additional charge to the Owner.

1.36 ASSEMBLY OF EQUIPMENT

A. The drawings and specifications make mention of numerous items to be purchased and installed and are noted by a manufacturer's name, catalog number and/or brief descriptions. The catalog number as mentioned may not be complete to designate all the accessory parts and appurtenances required for the particular use of function. Arrange with the manufacturer for the purchase of all items required for the complete installation and efficient operation of the equipment furnished.

1.37 CONDUIT INSTALLATION

A. All work shall be concealed in walls and above ceilings in finished areas unless otherwise noted. Exposed work shall be installed perpendicular or parallel to walls, ceilings, and structural members and coordinated with mechanical ducts, pipes, and equipment.

B. All work in finished rooms without ceilings; the conduit shall be run exposed as noted above. Conduit drops for outlets, switches, etc., shall be run concealed in the wall construction and shall enter the wall at a point at least 9'-6" above the floor.

1.38 ACCESS DOORS

A. Provide all access doors required for the electrical installation. Doors shall be as manufactured by Milcor or approved equal. In the walls and ceilings, doors shall be as required to make all controls, electrical boxes and equipment accessible, minimum size 12" x 12". The plaster or acoustical tile insert shall be by other Trades. Areas with lay-in or accessible ceilings will not require access doors.

1.39 SHOP DRAWINGS

A. Provide layout shop drawings drawn to scale and submit one (1) transparency copy and two (2) prints of each to the Owner's Representative for review, together with required number of additional copies as required by the General Conditions. After shop drawings are reviewed, the transparency copy will be stamped and returned for printing and distributions.

B. Layout shop drawings shall show building floor plans to scale and shall include lighting and power distribution systems, all details of electrical construction, routing of conduits, wiring, circuiting and related information necessary for the installation and future maintenance of the electrical wiring system.

C. The Contractor shall thoroughly check all shop drawings as regards to measurements, sizes of equipment, materials, and details to satisfy himself that they conform to the intent of Engineer's drawings and specifications. Drawings found to be inaccurate or otherwise in error are to be returned to the Subcontractors for correction before submitting same to the Engineers.

D. Drawings not approved must be corrected and returned for final approval. No shop drawings shall be used on the project unless approved by the Engineers. Three copies of all drawings submitted will be returned by the engineers. Contractor shall submit as many more copies as he desires to be returned. The Contractor shall furnish to the field, prints of checked and approved shop drawings as required to the construction operations.

E. After shop drawings have been submitted to the Engineer and returned to the Contractor approved, the Contractor will not be allowed to resubmit shop drawings of another manufacturer for this same item without the Engineer's consent.

F. No apparatus or equipment shall be shipped from stock or fabricated until shop drawings for same have been reviewed by the Owner's Representative. By the review of shop drawings the Owner's Representative does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Electrical Trades of full responsibility for the proper and correct execution of the work required.

G. Submit shop drawings with all pertinent data and with identification mark number as specified or scheduled.

H. Furnish and deliver to the Owner's Representative a manual of all manufacturers' shop drawings including brochures, pertaining to the Contract when work is completed. The manual shall consist of a standard hard cardboard, vinyl covered, 3-ring binder, letterhead size, 8-1/2" x 11". Shop drawings shall be folded and punched. All items and/or pages shall be numbered and typewritten, with index inserted at front of manual for ready reference.

I. Submit manufacturer's shop drawings on all major electrical systems and/or equipment including:

1. Occupancy sensors.
2. Panel components.
3. Panels.
4. Wiring devices.
5. Circuit breakers.
6. Disconnect switches.
7. Starters.

J. The following shop drawings shall be submitted in three ring binder "Brochure" form:

1. Lighting fixtures.
2. Audio/visual system.
3. Lighting control system.

1.40 PARTS RECEIPT

A. Retain all portable and detachable portions of the installation such as keys, tools, manuals, etc., until the completion of the work and then turn them over to the owner and obtain itemized receipt. This receipt shall be attached to the “Final Application” for payment.

1.41 MATERIALS LIST

A. Submit a complete list of all materials and equipment, and their manufacturers, for approval within 15 days after award of contracts, prior to submittal of shop drawings. Refer to General Conditions.

1.42 CERTIFICATE OF APPROVAL

A. Upon completion of the building, provide Owner's Representative with Certificate of Approval from electrical inspection authority and all other certificates of inspection and approval which are customary for the classes of work involved.

1.43 QUALITY OF WORKMANSHIP

A. Execute the work required in a manner evidenced by the "best trade practices" contributing to efficiency of operation, minimum maintenance, accessibility and aesthetics of the installation.

B. Equipment and materials, unless noted otherwise, shall be new and shall conform to the requirements of standard specifications and tests of organizations as listed in this division and in the requirements noted in other sections of Divisions 26, 27 and 28.

1.44 MANUALS AND BROCHURES

A. Upon completion of work, furnish Owner with four sets of manufacturer’s instruction books, maintenance brochures, descriptive brochures, and spare parts brochures for equipment listed in the specification. One complete set shall be bound into book form for the Owner's use.

1.45 FIRE STOPPING

A. Contractor shall be responsible to provide and install all material required for fire stopping electrical penetrations through fire rated floors, ceilings, roof and walls, per Section 07270 "Fire Stopping."

1.46 STRUCTURAL DIFFICULTIES

A. Should any construction conditions prevent the installation of switches, conduit, outlet boxes, junction boxes, conductors, lighting fixtures and/or related equipment at locations shown on drawings, minor deviations may be permitted and shall be directed by the Owner's Representative and shall be made without any additional cost to the Owner.

1.47 STEEL

A. Provide all steel leveling channels, miscellaneous auxiliary structural and supporting steel required for mounting and hanging electrical equipment. All steel work used in damp or wet locations shall be hot dipped galvanized steel. All steel work shall be in conformance with the Structural Trades Division of this specification.

1.48 SLEEVES, CHASES, AND RECESSES

A. Provide conduit sleeves where conduits pass through poured-in-place concrete floors, walls, beams, and ceilings. Sleeves shall be galvanized rigid steel conduit. Aluminum conduit shall not be used. Where specific sizes are not indicated on drawings, sleeves shall be sized to provide one-half (1/2) inch clearance around the outside surface of the item for which they were installed. They shall be flush with wall surfaces, and shall extend one inch, or as directed, above the finished floor levels. The space between conduit and sleeves shall be packed with fiberglass or other approved non-combustible packing material to prevent passage of air, liquid, or fumes from one area to another.

B. The filler materials used shall be rated at least equal to the fire resistance of the construction material being penetrated.

1.49 OUTSIDE POWER TRANSMISSION AND DISTRIBUTION

A. Work by the Contractor:

Provide and install 4" underground conduits between DTE Co. primary electric service power pole and pad mounted transformer.

Remove existing concrete pad, meter, secondary service conduit and wiring, etc.

Provide and install underground secondary service conduit and wiring to make connection between main service equipment and DTE Co. pad mounted transformer.

Provide and install concrete pad and footings for DTE Co. pad mounted transformer per DTE Co. standards.

All charges by DTE Company for installation of meter, C/T's, pad mounted transformer, primary wiring, etc. will be paid by the Owner.

B. Work by DTE Company:

Remove existing pad mounted transformer, primary wiring, etc.

Provide and install meter, C/T's, pad mounted transformer, primary underground wiring, etc.

C. Coordination: All coordination with DTE Company shall be the responsibility of the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)
END OF SECTION 260500

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire and cable.

B. Feeder and branch circuit cable.

C. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Division 26 Section 260533 – Raceway and boxes for Electrical Systems

B. Division 26 Section 260553 – Identification for Electrical Systems

C. Division 26 Section 280513 – Conductors and Cables for Electronic Safety and Security

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code, current edition.

1.4 SUBMITTALS

A. Product Data: Provide for each cable assembly type.

B. Test Reports: Indicate procedures and values obtained.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

D. Material construction data, insulation thickness, jacket thickness test data, and sample shall be submitted for approval upon request.

E. Qualification Data: For testing agency.

F. Field quality-control test reports.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to standard requirements of specifications and the tests established for such materials and construction by ANSI, NFPA 70, NEMA, AEIC and ICEA where applicable.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. All wire and cable shall conform to the latest requirements of the current edition of the NEC and shall meet all ASTM Specifications. Wire and cable shall be new; shall have size, grade of insulation, voltage and manufacturer's name permanently marked on outer covering at regular intervals; shall be delivered in complete coils or reels with identifying size and insulation tags.

D. Material construction data, insulation thickness, jacket thickness, test data, and sample shall be submitted for approval upon request.

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

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 NFPA 70.

D. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.10 REGULATORY REQUIREMENTS

A. Conform to standard requirements of specifications and the tests established for such materials and construction by ANSI, NFPA 70, NEMA, AEIC, and ICEA where applicable.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. All wire and cable shall conform to the latest requirements of the current edition of the NEC and shall meet all ASTM Specifications. Wire and cable shall be new; shall have size, grade of insulation, voltage and manufacturer's name permanently marked on outer covering at regular intervals; shall be delivered in complete coils or reels with identifying size and insulation tags.

D. Material construction data, insulation thickness, jacket thickness test data, and sample shall be submitted for approval upon request.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - BUILDING WIRE AND CABLE

A. Southwire

B. Triangle

C. Carol

D. General Electric

E. General Cable

F. Okonite

G. Anaconda

H. American Steel and Wire

I. Kaiser

J. United Technologies (Essex)

K. I.T.T. Royal

L. Rome

2.2 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Stranded soft-drawn copper with 98% conductivity.

C. Insulation Voltage Rating: 600 volts.

D. Insulation:

1. ANSI/NFPA 70; 75 deg C insulation for No. 1 AWG and smaller, type THWN/THHN or XHHW.
2. ANSI/NFPA 70; 90 deg C insulation for No. 1/0 AWG and larger, type THWN/THHN or XHHW.
3. Service entrance conductors shall be type XHHW. THHN shall be used in dry locations only.
4. All other wiring, unless otherwise noted, shall be THHN, THWN, XHHW, or type THW unless a higher temperature wire is required to feed lighting fixtures, high temperature cutouts, etc.

E. Minimum size wire shall be #12 AWG unless otherwise noted.

F. Grounding conductor for all convenience receptacles, outlet boxes and other items requiring grounding shall be #12 AWG copper minimum, with green insulation.

G. Wire for use in LED fixture wiring channels shall be polyvinyl chloride (PVC) insulated with not less than 3/64" insulation and shall conform to UL requirements for fixture and appliance wire rated 105 deg C, 600 volts.

H. Wire for general interior use, sizes No. 10 AWG and smaller, shall be single conductor, annealed copper and shall meet UL requirements for Type "THHN" or "THWN", 75 deg C, 600 volts.

I. Wire for general interior use, small sizes No. 8 AWG and larger shall be stranded, annealed copper insulated with a moisture and heat resisting compound meeting UL requirements for Type "XHHW" or "THHN," 90 deg C, 600 volts.

J. All conductors shall be new, unused product as furnished direct from manufacturer through their authorized service distribution arrangement and delivered to job site in the original manufacturer containers.

K. Conduit sizes are based on THW conductors.

L. Wire sizes shall have current rating equal to or greater than the fuse or circuit breaker trip size indicated on the Contract Documents.

M. Copper Conductors: Comply with NEMA WC 70.

N. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN and XHHW.

O. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC and Type USE with ground wire.

P. Romex not allowed.

2.3 WIRING CONNECTORS

A. Split Bolt Connectors:

1. Ilsco
2. Burndy Corp.
3. GE Electric Inc.

B. Solderless Pressure Connectors:

1. Ilsco
2. Burndy Corp.
3. Thomas & Betts

C. Spring Wire Connectors:

1. Ideal
2. 3M - Electrical Products
3. Buchanan

D. Compression Connectors:

1. Ilsco
2. Burndy Corp.
3. Square D

2.4 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section 078413 "Penetration Firestopping."

2.5 SLEEVE SEALS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Pipeline Seal and Insulator, Inc. or a comparable product.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that mechanical work likely to damage wire and cable has been completed.

B. Feeders: copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Verify that interior of building has been protected from weather.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

A. Concealed Dry Interior Locations: Use only building wire, Type THW, THHN, THWN, or XHHW insulation, in raceway.

B. Exposed Dry Interior Locations: Use only building wire, Type THW, THHN, THWN, or XHHW insulation, in raceway.

C. Above Accessible Ceilings: Use only building wire, Type THW, THHN, THWN, or XHHW insulation, in raceway.

D. Wet or Damp Interior Locations: Use only building wire, Type XHHW insulation, in raceway.

E. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
   1. Exposed Dry Interior Locations: Use only building wire, Type THW, THHN, THWN or XHHW insulation in raceway.

F. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THW, THHN-THWN or XHHW single conductors in raceway.

G. Class 1 Control Circuits: Type THHN-THWN in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

3.4 INSTALLATION

A. Install products in accordance with manufacturers' instructions.

B. Use stranded conductors for feeders and branch circuits.

C. Use stranded conductors for control circuits.

D. Use conductors not smaller than 12 AWG for power and lighting circuits.

E. Use conductors not smaller than 14 AWG for control circuits.

F. Use 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.

G. Use 10 AWG conductors for 20 ampere, 208-volt branch circuits longer than 200 feet.

H. Pull all conductors into raceway at same time.

I. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

J. Protect exposed cable from damage.

K. Neatly train and lace wiring inside boxes, equipment, and panelboards.

L. Clean conductor surfaces before installing lugs and connectors.

M. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

N. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

O. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

Q. Before conductors are inserted in conduit runs, the conduits shall be swabbed or the equivalent to insure their dryness and freedom from foreign matter detrimental to the conductor insulation. All wiring shall be installed before finishes are applied to wall and ceiling surfaces.

R. Wire and cable shall be suitably protected from weather and damage during storage and handling and shall be in first-class condition when installed.

S. Splices in conductors No. 8 and smaller shall be made by pre-insulated "Scotchlock" or Ideal "Wing-Nut" spring tension connectors, installed in strict accordance with manufacturer's recommendations. Splices of No. 6 conductors and larger shall be made with solderless, compression type connectors, UL labeled and compressed with approved tools.

T. All splices shall be insulated with an approved vinyl plastic all weather tape to a thickness equivalent of the conductor insulation.

U. Conductors used to feed normal power circuits and lighting shall be installed in conduit used exclusively for each of these individual systems.

V. Size as required to meet N.E.C. conductor fill requirements.

W. All splices, taps and connections in outlet boxes, junction boxes and in equipment cabinets for #14, #12 and #10 conductors shall be made with squeeze connectors as manufactured by Buchman Electric Products Corporation, Scotchlok Electric spring connectors as manufactured by Minnesota Mining and Manufacturing Company or Wrap-Cap as manufactured by Ideal Industries, Inc.

X. Provide #10 neutrals on all 120/208V multi-phase branch circuits; provide #8 neutrals on circuits longer than 75 feet.

Y. All 120/208V feeder neutrals shall be rated at 200%.

Z. All emergency circuits shall be No. 10, minimum.

AA. Conductors for power, audio visual system and lighting systems shall each be installed in separate conduit system.

BB. Use manufacturer-approved pulling compound or lubricant for building wire 4 AWG and larger; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

CC. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

DD. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

EE. Support cables according to Division 26 Section 260529 "Hangers and Supports for Electrical Systems."

FF. Identify and color-code conductors and cables according to Division 26 Section 260553 "Identification for Electrical Systems."

GG. Completely and thoroughly swab raceway before installing wire.

HH. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 260553.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each branch circuit conductor.

D. Verify continuity of control circuits.

E. Remove and replace malfunctioning units and retest as specified above.

F. Engage a qualified testing agency to perform tests and inspections and prepare test reports.

G. Perform tests and inspections and prepare test reports.

H. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
      a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
      b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
      c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

I. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.7 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 and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
1. Splices in conductors No. 8 and smaller shall be made by pre-insulated “Scotchlok” or equal spring tension connectors, installed in strict accordance with manufacturer’s recommendations. Splices of No. 6 conductors and larger shall be made with solderless, compression type connectors, UL labeled and compressed with approved tools.
2. All splices, taps and connections in outlet boxes, junction boxes and in equipment cabinets for #14, #12 and #10 conductors shall be made with squeeze connectors as manufactured by Buchman Electric Products Corporation or equal.
3. All splices shall be insulated with an approved vinyl plastic all weather tape to a thickness equivalent of the conductor insulation.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.8 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section 078413 "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:
1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assembly.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section 079200 "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section 078413 "Penetration Firestopping."

3.9 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.10 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section 078413 "Penetration Firestopping."

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical equipment and raceway grounding and bonding.

B. Equipment grounding conductors.

C. Power system grounding.

D. Communication system grounding.

1.2 SYSTEM DESCRIPTION

A. Provide complete grounding system in accordance with NEC requirements, and additional grounding as indicated on drawings and specified herein.

B. Ground each separately derived system neutral to grounding electrodes.

C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code, current edition.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms

1.5 SUBMITTALS

A. Product Data: Provide data for grounding connections.

B. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of exothermic connectors.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section 017823 "Operation and Maintenance Data," include the following:
   1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.
      a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
      b. Include recommended testing intervals.

F. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Grounding arrangements and connections for separately derived systems.
   2. Grounding for sensitive electronic equipment.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017839.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 – National Electrical Code latest edition, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

D. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. Electrical system grounding and grounding of non-current carrying metal parts of electrical equipment shall in all instances conform to the minimum requirements of the National Electrical Code with additional grounding as shown on the drawings and as specified hereinafter.

PART 2 - PRODUCTS

2.1 MECHANICAL CONNECTORS

A. Manufacturers:

1. Burndy
2. Erico
3. G&W

B. Material: Bronze

2.2 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Cadweld
2. G&W
3. Burndy

2.3 WIRE

A. Material: Stranded copper conductors, ASTM B8.

B. The minimum size conductor to be used for electrical system grounding in any case shall be No. 6, except as noted on the drawings. Where conduit is used for mechanical protection of a grounding conductor, the conductor shall be securely bonded to the conduit at each end.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

D. Insulated Conductors: Stranded copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

E. Bare Copper Conductors:
1. Material: Stranded Copper.
2. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
3. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

2.4 ACTIVE ELECTRODES

A. Manufacturers:

1. Burndy
2. Erico
3. G&W

B. Description: Copper

2.5 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

E. Manufacturers:

   1. Bundy or equal.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Flexible raceway runs.
   5. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the distribution panel to equipment grounding bar terminal on busway.

3.3 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Provide a separate insulated equipment grounding conductor in all branch circuits.

C. Provide a separate, insulated equipment grounding conductor in all feeder circuits. Terminate each end on a grounding lug, bus, or bushing.

D. Grounding connections at main power panelboard, and other non-permanently fixed equipment shall be by means of lugs bolted to the equipment.

E. The enclosures of all heavy-duty equipment shall be grounded with a separate grounding conductor connected to the nearest ground conductor comprising a part of the electrical system ground. All metal non-current carrying parts of electrical equipment, raceways, including those completely or partially embedded in concrete floor slabs shall be grounded to meet the latest NEC requirements.

F. Equipment grounding conductors shall be identified with a green color code, neutral with white color code.

G. All receptacle grounding terminals and metal non-current carrying parts of electrical equipment raceways and supports shall be grounded to meet NEC requirements.

H. Use minimum #4 AWG copper conductor for communications service grounding conductor.

I. 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.

J. Install Products in accordance with manufacturer's instructions.

K. 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.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

L. Where plastic or other non-metallic conduit is used a code sized stranded copper wire shall be provided the full length of the conduit.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. 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 each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**,** and 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.

4. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.
5. Inspect grounding and bonding system conductors for tightness and proper installation.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

I. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

J. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, grounding, bonding, conductors and equipment installations, including connections for tightness and proper installation.

3.5 LABELING

A. Comply with requirements in Division 26 Section 260553 "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Hangers and supports for conduits, electrical equipment and systems.

B. Fastening hardware.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 SUBMITTALS

A. Product Data: For the following:
1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

B. Comply with NFPA 70.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by Unistrut; Tyco International, Ltd. or equal.
2. Channel Dimensions: Selected for applicable load criteria.
3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

B. Hardware: Corrosion resistant steel with gray paint finish.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Corrosion resistant steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. 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.
   a. Manufacturers: Subject to compliance with requirements, provide products by Hilti Inc. or equal.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by Cooper B-Line, Inc.: a division of Cooper Industries or equal.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

H. Support Channel: Galvanized or painted steel for mounting of equipment, outlets and for racking conduits shall be of type required or indicated for the location

I. Channels shall be "Unistrut," "Kindorf," or approved equal.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using beam clamps. Do not use spring steel clips and clamps.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces.

C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

D. Do not drill structural steel members.

E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

F. In areas of applied fireproofing install hanger supports prior to application of fireproofing. See architectural drawings for areas of applied fireproofing. Correlate installation of supports with fireproofing contractor.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall.

H. Install equipment in accordance with manufacturer's instructions.

I. Support all electrical items independently of supports provided by the other trades.

J. Support rigid raceways and boxes using 1/4 inch minimum diameter threaded rod hangers. Suspended ceiling hangers or hanger wire shall not be used.

K. Route and independently support electrical nonmetallic tubing in a neat and workmanlike manner, and secure at intervals not exceeding 3 feet.

L. Flexible metallic conduit and flexible manufactured wiring may be supported from suspended ceiling hangers, or hanger wires, at intervals not exceeding 3 feet provided they do not obstruct removal of ceiling tiles.

M. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

N. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

O. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

P. 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. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
3. To Masonry: Approved toggle-type bolts or hollow wall fasteners on hollow masonry, plaster or gypsum board partitions and walls, units and expansion anchor fasteners or preset inserts on solid masonry units.
4. To Concrete: Self-drilling or expansion anchor fasteners on concrete surfaces.
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 (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.

Q. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

R. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 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 (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes raceways, fittings, boxes and enclosures for electrical wiring including the following:

1. Conduit:
   a. Metal conduit
   b. Flexible metal conduit.
   c. Liquidtight flexible metal conduit.
   d. Electrical metallic tubing.
   e. Fittings and conduit bodies.
   f. Romex is not allowed.
   g. Nonmetallic conduit.
   h. Electrical nonmetallic tubing.

B. Methods

1. Electrical connections to equipment specified under other sections.

2. Boxes:
   a. Wall and ceiling outlet boxes.
   b. Pull and junction boxes.
   c. Floor boxes.

3. Enclosures:
   a. Hinged cover enclosures.
   b. Accessories.

1.2 RELATED SECTIONS

A. Division 26 Section 26500 “Common Work Results for Electrical”.

B. Division 26 Section 260519 “Low-Voltage Electrical Power Conductors and Cables”.

C. Division 26 Section 260526 “Grounding and Bonding for Electrical Systems”.

D. Division 26 Section 260529 “Hangers and Supports for Electrical Systems”.

E. Division 26 Section 260533 “Raceways and Boxes for Electrical Systems”.

F. Division 26 Section 260553 “Identification for Electrical Systems”.

G. Division 26 Section 26600 “Mounting Heights of Equipment”.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. NEMA WD6 - Wiring Device Configuration.

D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

E. ANSI/NFPA 70 - National Electrical Code, current edition.

F. NECA "Standard of Installation."

G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

H. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

I. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

J. NEMA WD 1 - General Purpose Wiring Devices.

K. ANSI/NEMA OS 1 – Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

L. ANSI/NEMA OS 2 – Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

M. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70

1.5 SUBMITTALS

A. Product Data: Provide for metallic conduit, enclosures, outlet boxes, pull and junction boxes, terminal blocks, flexible metal conduit, metallic tubing, flexible nonmetallic conduit, fittings, conduit bodies, and conduit fittings.

B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

D. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.

E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

F. Source quality-control test reports.

G. Qualification Data: For professional engineer and testing agency.

H. Samples for Initial Selection: For wireways with factory-applied texture and color finishes.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017839 “Project Record Documents”.

B. Accurately record actual routing of buried, embedded, or concealed conduits larger than 1/2 inches.

C. Accurately record actual locations and mounting heights of outlet, pull and junction boxes.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. Conform to requirements of ADA for mounting heights of devices.

1.8 FIELD SAMPLES

A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough in of electrical connections to coordinate with installation schedule for equipment.

D. Sequence electrical connections to coordinate with start-up schedule for equipment.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 01700.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.10 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough in.

C. Electrical boxes are shown on drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

D. Verify locations of outlets in restrooms and work areas prior to rough in.

1.11 IDENTIFICATION OF WIRES

A. Branch circuit wiring shall be color coded as follows:

1. Black - First Circuit in one conduit.
2. Red - Second Circuit in one conduit.
3. Blue - Third Circuit in one conduit.
4. White - Neutral Circuit Wires.
5. Green - Ground Conductors.

B. Wires and cables for main feeders and power wiring shall be black. Neutrals shall be painted white in panels. Ground conductors shall be green.

1.12 MOTORS

A. All electric motors for equipment supplied elsewhere in these specifications shall conform to the latest revision of NEMA Motor and General Standards.

B. Unless otherwise noted, all motors will be provided and installed by other trades for final connections by the Contractor.

1.13 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. NBR: Acrylonitrile-butadiene rubber.

H. ENT: Electrical nonmetallic tubing.

I. RNC: Rigid nonmetallic conduit.

1.14 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size: 1/2 inch trade size unless otherwise specified.

1. Conduit sizes are based on THW conductors.

B. Wet and Damp Locations: Use galvanized rigid steel with threaded fittings.

C. Dry Locations:

1. Concealed: Use electrical metallic tubing through 4", in dry wall partitions and above lay-in ceilings.
2. Exposed: Use electrical metallic tubing through 2", in all other locations.
3. 600V Feeders Trade Size Larger Than 2": Rigid steel with threaded fittings. Provide sweeps in lieu of elbows.

D. Underground Installations:

1. More than Ten Feet From Foundation Wall: Use Schedule 40 nonmetallic conduit.
2. Within Ten Feet From Foundation Wall: Use galvanized rigid steel conduit.
3. In or Under Slab on Grade: Use galvanized rigid steel conduit.
4. On sizes 1-1/2 inch and larger, provide hot-dip galvanized sweep ells for all bends.
5. Minimum size: 3/4 inch.
6. Provide grounding conductor in each plastic conduit in accordance with National Electrical Code.

E. In Slab Above Grade:

1. Use galvanized rigid steel conduit.
2. Maximim Size Conduit in Slab: 1 inch.

2.2 METAL CONDUIT

A. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: ANSI/NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed. Material to match conduit.

1. Fittings for EMT: set-screw or compression type.

2. Coating For Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

B. Manufacturers: Subject to compliance with requirements, provide products by AFC Cable Systems, Inc. or equal by the following:
1. Triangle PWC
2. Wheatland
3. Allied Steel Conduit

C. Rigid Steel Conduit: ANSI C80.1.

D. LFMC: Flexible steel conduit with PVC jacket.

E. Intermediate Metal Conduit (IMC): ANSI C80.6, rigid steel.

F. FMC: Zinc-coated steel.

G. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

1. Triangle PWC
2. Wheatland
3. Allied Steel Conduit

I. Rigid Steel Conduit: ANSI C80.1

J. Intermediate Metal Conduit (IMC): Rigid steel

K. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.

2. Coating Thickness: 0.040 inch (1 mm), minimum.

2.3 LIQUID TIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. AFC
2. Electri-Flex Co.
3. O.Z. Gedney

B. Description: Polyvinyl jacket extruded over interlocked steel construction.

C. Fittings: ANSI/NEMA FB 1

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Triangle PWC
2. Wheatland
3. Allied Steel Conduit

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type.

2.5 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper B-Line, Inc.
   2. Hoffman.
   3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include 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.

D. Wireway Covers: Hinged type

E. Finish: Manufacturer's standard enamel finish.

2.6 BOXES AND ENCLOSURES

A. Manufacturers: Subject to compliance with requirements, provide products by Hoffman or equal.

B. All surface-mounted outlet boxes shall be Crouse-Hinds FS series or equal by Killark or Appleton, with threaded hubs as required.

C. Sheet Metal Outlet and Device Boxes: ANSI/NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.
   3. All flush mounted outlet boxes shall be not less than 1-1/2 inch deep, of type and size to accommodate devices specified with proper space for wire and supports. Boxes shall be equipped with plaster rings or covers as required.
   4. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.

D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, cast ferrous alloy, Type FD, with gasketed cover by box manufacturer. Provide threaded hubs.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, held closed by flush latch operable by key, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic.
   3. Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
   4. Enclosure Finish: Manufacturer’s standard enamel.

H. Flush Mounted Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; including male fixture studs where required.

I. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.

2.7 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.8 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic . Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.9 HINGED COVER ENCLOSURES

A. Construction: NEMA 250, Type 1 steel enclosure.

B. Covers: Continuous hinge, held closed by flush latch operable by key.

C. Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.

D. Enclosure Finish: Manufacturer's standard enamel.

2.10 ACCESSORIES

A. Plastic Raceway:

1. Panduit Corp.
2. Hoffman Eng. Co.
3. Tyton Corp.

2.11 TERMINAL BLOCKS

A. Manufacturers:

1. Square D Co.
2. Thomas & Betts Corp.
3. Ideal Industries, Inc.

B. Terminal Blocks: ANSI/NEMA ICS 4.

C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

E. Provide ground bus terminal block, with each connector bonded to enclosure.

2.12 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel, screw cover type.

B. Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.

1. Material: Cast aluminum.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. Boxes shall be sized to accommodate the number of conductors and conduits shown and be in accordance with code requirements. Size as required to meet NEC conductor fill requirements.

D. Junction boxes and pull boxes shall be of code gauge steel, screw cover type with removable covers fastened with self-tapping screws. Flush mounted flange type shall be used where boxes are installed in finished areas.

2.13 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar opening to match piping OD.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Presealed Systems or comparable product.

2.14 GROUT

A. Description: Nonshrink; 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 (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.15 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. Sealant shall have VOC content calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

2.16 FLOOR BOXES

A. Floor Boxes: ANSI/NEMA OS 1, fully adjustable. UL 514 A/C for multi-service shallow steel recessed flush floor boxes.

B. Material: Cast metal steel with load bearing PVC top and aluminum recessed activation access cover.

C. Shape: Rectangular, arranged for isolated power and voice/data communications service.

D. Conform to regulatory requirements for concrete-tight floor boxes.

E. Multi-Service flush floor boxes to be Walkerbox Resource RFB with RAKM II covers by Walker/Wiremold or approved equal.

F. Watertight, gang type, installed level with finished floor surface and shall include finishes, service fittings and accessories as herein specified or shown on the drawings.

2.17 NONMETALLIC CONDUIT

A. Manufacturers:

1. Carlon
2. Endot Industries
3. Can-Tex

B. Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.18 NONMETALLIC TUBING

A. Manufacturers:

1. Carlon
2. Can-Tex
3. Spiraduct

B. Description: NEMA TC 2.

C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Do not install aluminum conduits.

B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.

2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
   a. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT or flexible steel conduit (MC Cable).
5. Connection to Vibrating Equipment (Including Transformers and Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Galvanized rigid steel conduit.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz.

3.2 INSTALLATION - RACEWAYS

A. Install conduit in accordance with NECA "Standard of Installation."

B. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

C. Arrange supports to prevent misalignment during wiring installation.

D. Flexible conduit shall be supported at 3'-0" maximum intervals.

E. Install nonmetallic conduit in accordance with manufacturer’s instructions.

F. Group related conduits; support using conduit rack. Construct rack using steel channel or framing channel.

G. Fasten conduit supports to building structure and surfaces under provisions of Section 260529 “Hangers and Supports for Electrical Systems”, with 1/4" rods minimum.

H. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

I. Size equipment support threaded rods, threaded rods shall be a minimum of 1/4 inch.

J. Do not attach conduit to ceiling support wires, ceiling grid systems, or supports of other trades.

K. Arrange conduit to maintain headroom and present neat appearance.

L. Route conduit parallel and perpendicular to walls.

M. Conduit and fittings shall conform to the following:

1. Steel conduit, elbows and couplings shall be hot dipped galvanized and conform to the latest ANSI Specifications for Steel Conduit, Zinc-Coated and shall be Pittsburgh, Republic, Triangle or Wheatland.

2. Liquid-tight flexible steel conduit shall be flexible steel with a PVC jacket and integral installed copper ground wire and shall be "Seat-Tite," "Electric-Flex," or approved equal. Fittings shall be designed to maintain the liquid-tight and ground feature. Liquid-tight conduit shall be Underwriter's approved and equal to Anaconda Type "UA" or Gedney Type "U.A.G."
3. Fittings for steel conduit shall be cast or malleable iron bodies, cadmium or zinc-plated, and with screw attached cover of an appropriate material. Fittings shall be a type providing maximum wiring space and shall be Appleton Form 35, Crouse Hinds Form 7, O. Z. Gedney, or approved equal. Locknuts for steel conduit shall be made of malleable iron or steel zinc or cadmium plated.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Connectors and couplings for electrical metallic tubing shall be of the setscrew type as manufactured by T & B, Midwest, or Electric Tube Products Co.

P. Maintain adequate clearance between conduit and piping.

Q. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 deg F.

R. Cut conduit square using saw or pipecutter, de-burr cut ends, and provide proper bushings, fittings, etc., so that no rough edges are left at the end of conduits.

S. Exposed conduit shall be installed parallel, or at right angles to adjacent building lines, and shall be supported at intervals not exceeding eight feet.

T. Conduits shall not be installed within 3" of hot water lines. Do not run conduits beneath concrete pads.

U. No beams or other structural members shall be drilled, burned, or cut without written approval of the Structural Engineer.

V. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

W. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

X. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

Y. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers with 1/4" rods minimum.

Z. Provide a nylon 200-pound test pull string in each empty conduit except sleeves and nipples.

AA. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

BB. Ground and bond conduit under provisions of Section 260526 "Grounding and Bonding for Electrical Systems".

CC. All floor and wall penetrations shall be sealed to maintain fire/smoke rating, of penetrated floor or wall.

DD. Identify conduit under provisions of Section 260533 "Identification for Electrical Systems".

EE. Provide flexible connections to resiliently mounted equipment.

FF. Perforated iron straps or soft iron wire for pipe supports shall not be used.

GG. Conduit shall be delivered to the site in standard 10-foot lengths, each length bearing the UL label. Hot-dip galvanized conduit shall be so labeled.

HH. All conduit shall be securely fastened in place with approved clamps and carefully reamed before installing.

II. All conduits in finished areas shall be installed in the building construction where possible, otherwise use surface wiremold, painted. Verify color with architect. Exposed conduits may be used only in the electrical and mechanical equipment rooms and where indicated on the drawings.

JJ. Pipe straps used in exposed work shall be one hole malleable iron galvanized. Groups of conduits shall be supported on trapeze hangers, Unistrut, Kindorf, Powerstrut or approved equal. Individual conduit not supported on pipe straps shall be provided with clevis type hangers. Hanger supports shall be rod or pipe with threaded connections. All exposed conduit shall be supported at least every 8 feet if smaller than 2", and at least every 10 feet if 2" and larger.

KK. Bushings for steel conduit one (1") inch or smaller shall be plastic. Plastic bushings shall be thermosetting phenolic insulating type, non-burnable and conforming to Federal Specification SF-406 and Amendment 6. Bushings 1-1/2" and larger shall be made of malleable iron or steel and shall have an insulating insert of thermosetting plastic molded to a locking surface on the bushing ring.

LL. Install four (4) one-inch conduits from each new lighting and receptacle panel into nearest accessible ceiling space for future use. Terminate conduits in 4-11/16" square boxes in each location.

MM. All wiring shall be enclosed in a metal raceway unless otherwise noted.

NN. All joints shall be made watertight and all raceways shall be perfectly dry when wires are pulled. Pockets of water collecting points in the installation shall be avoided.

OO. Conduits shall not be supported from mechanical ducts, pipes or pipe and duct supports, unless specifically approved by the Owner’s Representative.

PP. Connectors and couplings for electrical metallic tubing shall be of the setscrew type and manufactured by T & B, Midwest, or Electric Tube Products Co.

QQ. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.

RR. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

SS. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

TT. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.

UU. Conceal conduit and EMT within finished walls, ceilings, and floors in finished areas, unless otherwise indicated.

VV. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

WW. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

XX. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

YY. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:
1. Where conduits pass from warm to cold locations.
2. Where otherwise required by NFPA 70.

ZZ. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

AAA. Provide sleeve at all floor penetrations, make watertight and leave 2 inches above finished floor and below finished slab bottom.

BBB. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.

CCC. Flexible conduit shall be supported at 3'-0" maximum intervals.

DDD. Outlet boxes installed in conduit run concealed in the building construction shall be pressed metal type to accommodate the fixture tap or connection required. Fixture studs shall be provided in all outlet boxes utilized at ceiling or pendent mounted lighting fixtures.

EEE. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

FFF. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

GGG. Complete raceway installation before starting conductor installation.

HHH. Support raceways as specified in Division 26 Section 260529 “Hangers and Supports for Electrical Systems”.

III. Exposed conduits may be used only in the electrical and mechanical equipment rooms and where indicated on the drawings.

JJJ. Individual conduits not supported on pipe straps shall be provided with conduit clamps or ring hangers suspended on rods.

KKK. Flexible steel conduit shall be used for short connections between outlet boxes in hung or furred ceilings and flush type lighting fixtures and trough units. It shall not be used in place of rigid conduit. It shall be galvanized single strip equal to "Greenfield" or "Flexsteel" with single threaded type fittings equal to "Tomic" 300 Series. If damp conditions prevail, flexible conduit shall be neoprene covered grounded type

equal to Sealtite Type UA with Appleton Type ST fittings. Use neoprene covered flexible conduit to all motor connections. Absolutely no 3/8-inch flexible conduit will be permitted.

LLL. All exposed conduit shall be supported at least every 8 feet if smaller than 2 inches, and at least every 10 feet if 2 inches and larger.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire/smoke resistance rating of partitions and other elements. All penetrations through fire rated barriers shall be made in accordance with the methods in UL Fire Resistance Directory - Volume 2 for through - penetration firestop systems.

B. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

C. Position outlet boxes to locate luminairies as shown on reflected ceiling plan.

D. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

E. Route conduit through rod openings for piping and ductwork or through suitable roof support with pitch pocket.

3.4 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Flexible steel conduit shall be used for short connections between outlet boxes in hung or furred ceilings and flush type lighting fixtures and trough units. It shall not be used in place of rigid conduit. It shall be galvanized single strip equal to "Greenfield" or "Flexsteel" with single threaded type fittings equal to "Tomic" 300 series. If damp conditions prevail, flexible conduit shall be neoprene covered grounded type equal to Sealtite Type UA with Appleton Type ST fittings. Use neoprene covered flexible conduit to all motor connections. Absolutely no 3/8" flexible conduit will be permitted.

G. Modify equipment control wiring with terminal block jumpers as indicated.

H. Provide interconnecting conduit and wiring between devices and equipment where indicated, or required.

I. Connectors and couplings for electrical metallic tubing shall be of the setscrew type as manufactured by T & B, Midwest, or Electric Tube Products Company.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section 078413 "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:
1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section 079200 "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section 078413 "Penetration Firestopping."

L. Comply with NECA 1.

M. Comply with NEMA VE 2 for cable penetrations.

N. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

O. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

3.6 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

B. Sleeve-Seal-Fitting Installation:
   1. Install sleeve-seal fittings in new walls and slabs as they are constructed.
   2. 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.
   3. Secure nailing flanges to concrete forms.
   4. Using grout, seal the space around outside of sleeve-seal fittings.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section 078413 "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.9 INSTALLATION - BOXES

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Install boxes to preserve fire resistance rating of partitions and other elements.

F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

G. Use flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated walls.

I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

J. Use stamped steel bridges to fasten flush mounting outlet box between studs.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

O. Use gang box where more than one device is mounted together. Do not use sectional box.

P. Use gang box with plaster ring for single device outlets.

Q. The face of any outlet recessed in any wall shall be within 1/4 inch of the face of the wall. Therefore, all plaster rings of all outlets in masonry walls shall be minimum 1-1/4 inch deep. Also, all conduits must be installed so that the mason may install 1-1/2 inch minimum of masonry in front of conduits. Should the faces of any outlet be recessed more than 1/4 inch, the outlet shall be moved and the wall repaired at the expense of the Contractor.

R. Size as required to meet NEC conductor fill requirements.

S. Conductors of lighting circuits shall not be installed in the same conduit with receptacle circuits. No outlet box for one conduit system shall be used as a junction box for any other system.

T. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
1. Interior Dry Locations: Use sheet metal enclosures.
2. Other Locations: Use surface-mounted cast metal box.

U. All outlet boxes shall be rigidly secured in place of an approved method.

V. No outlets shall be placed behind mechanical pipes or heating equipment or enclosures. Check drawings of other trades for door swings and sizes and locations of equipment and cabinets.

W. Conductors for power and lighting circuits shall each be installed in separate conduit systems.

X. Use cast floor boxes for installation in slab grade; formed steel boxes are acceptable for other installations.

Y. Set floor boxes level.

3.10 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Adjust floor box flush with finish flooring material.

3.11 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access doors with Section 08302.

B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

C. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

D. Position outlet boxes to locate luminaries as shown on reflected ceiling plan.

3.12 INSTALLATION – ENCLOSURES

A. Install Products in accordance with manufacturers' instructions.

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 “General Requirements” Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Division 07 Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 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 (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.

2. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Proco Products, Inc. or equal.
2. Sealing Elements: EPDM rubber 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.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Presealed Systems or comparable product.

2.4 GROUT

A. Description: Nonshrink; 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 (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 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. Sealant shall have VOC content calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section 079200 "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated 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.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. 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 that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. 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.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Nameplates and tape labels.

B. Power and control wire and cable markers.

C. Conduit color coding.

D. Identification for raceways.

E. Identification for conductors.

F. Warning labels and signs.

G. Instruction signs.

H. Equipment identification nameplates and tape labels.

I. Miscellaneous identification products.

1.2 RELATED WORK

A. Section 09900 - Painting

1.3 SUBMITTALS

A. Submit schedule for each nameplate for approval.

B. Samples: for each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.

B. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

2.2 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

G. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Three-Layer Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.9 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 “Finishes” painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - INSTALLATION

3.1 INSTALLATION

A. The Contractor shall clean conduits and paint with appropriate color coding as specified. This Contractor shall also degrease and clean surfaces and apply appropriate nameplates as specified.

B. Junction boxes shall be marked in indelible ink with panel and circuit numbers.

C. Install nameplates and tape labels parallel to equipment lines.

D. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

E. Embossed tape will not be permitted for any application.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Cable Ties: For attaching tags. Use general-purpose type.

H. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

I. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

K. Verify identity of each item before installing identification products.

L. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

M. Apply identification devices to surfaces that require finish after completing finish work.

N. Secure nameplates to equipment fronts using screws, rivets or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

3.2 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1. Emergency Power.
2. Normal Power.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
   b. Colors for 208/120-V Circuits:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral: White.
      5) Ground: Green.
   c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Controls with external control power connections.

F. Power-Circuit Conductor Identification, More than 600 V: For conductors in pull and junction boxes, use write-on tags nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
   b. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled:
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Enclosed switches.
   d. Monitoring and control equipment.

L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

3.3 NAMEPLATE ENGRAVING SCHEDULE

A. Provide nameplates to identify all electrical distribution and control equipment and loads served. Letter Height: 1/8 inch for individual switches and loads served, 1/4 inch for distribution and control equipment identification.

B. Provide nameplates of minimum letter height as scheduled below.

C. Panelboards: 1/4 inch, identify equipment designation; 1/8 inch, identify amperage, voltage rating and source, in three lines.

D. Individual Switches: 1/8 inch, identify circuit equipment served, location, and load (horsepower/amps and voltage rating), in three lines.

E. Concealed junction boxes shall be marked in indelible ink with the circuit numbers contained within.

3.4 CONDUCTOR COLOR CODING SCHEDULE

A. Provide for color coding of wire and cable as follows:

208/120 Volt Systems

Phase	Color
A	Black
B	Red
C	Blue
N	White
G	Green

END OF SECTION 260553

SECTION 262417 - PANELBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Panelboards (lighting and receptacle panels).

1.2 REFERENCES

A. FSW-C-375 - Circuit Breakers, Molded Case, Branch Circuit and Service

B. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment

C. NEMA AB 1 - Molded Case Circuit Breakers

D. NEMA PB 1 - Panelboards

E. NEMA PB 1.1 - Instructions for Safe Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

F. ANSI/NFPA 70 – National Electrical Code (latest edition).

1.3 SUBMITTALS

A. Product Data: For each type of product, accessory and component indicated. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
1. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement, sizes, and protective device time-current curves.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Integrated short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Operation and maintenance data.

D. Field quality-control reports.

E. Panelboard schedules for installation in panelboards.

F. Qualification Data: For qualified testing agency.

G. Field Quality-Control Reports:
1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

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 NEMA PB 1.

C. Comply with NFPA 70.

D. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

E. Source Limitations: Obtain overcurrent protective devices, components, and accessories from single source to match existing manufacturer.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

1.6 SPARE PARTS

A. Keys: Furnish two each to Owner.

B. Circuit breakers including normal, GFCI and ground fault equipment protection (GFEP) types; two spares for each new panelboard.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER - PANELBOARDS

A. Shall be Square D. Co. or approved equal by:

1. GTE Sylvania

2. General Electric Co.
3. Siemens Energy & Automation, Inc.
4. Eaton Corp. – Cutler Hammer/Westinghouse

2.2 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface or flush mounted cabinets as noted on drawings.
1. Rated for environmental conditions at installed location.
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location Top or bottom.

C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Power (PP) Panelboards, Lighting (LP) Panelboards and Receptacle (RP) Panelboards: NEMA PB1; circuit breaker type.

B. Enclosure: NEMA PB 1; Type 1.

C. Cabinet Size: 6 inches deep; 20 inches wide for 600 volt and less panelboards.

D. Provide surface cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.

F. Panelboards shall be equipped with 200% rated neutral bus, where indicated on panel schedules.

G. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical for panelboards.

H. Molded Case Circuit Breakers: NEMA AB 1; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for panel switched lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where indicated on drawings. Provide remote controlled circuit breakers, and associated control devices where indicated on drawings, complete with appropriate power supplies and interface.

I. Panels for 208 volt, three-phase, four-wire service shall be dead front Square D type NQOD, Class 1630, having bus bars with connections in mains for connection to feeders and with units in branches of number and ampere capacity shown on the plans, or equal by GTE Sylvania, General Electric Co., Siemens or Cutler Hammer/Westinghouse. Provide spare circuits as shown.

J. Provide magnetic trip action device for all motor circuits. All breakers of 120 lighting loads and 120-volt convenience outlets shall be 20-ampere minimum unless otherwise indicated.

K. Continuous main current ratings as indicated in associated schedules on drawings, not to exceed 600 amperes maximum.

L. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be Copper. Bussing rated for 600 amperes shall be copper as standard construction.

M. All current carrying parts shall be insulated from ground and phase-to-phase by Noryl high Dielectrric strength thermoplastic or equivalent.

N. Split solid neutral shall be plated and located in the main compartment up to 225 amperes so all incoming neutral cable may be of the same length.

O. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have preformed twistouts covering unused mounting space.

P. Interiors shall be field convertible for top or bottom incoming feed. Main and sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

Q. Cabinets of panels shall be of code gauge galvanized steel with proper space for all wires and connections shall bear Underwriter's Laboratories inspection label.

R. All cabinets shall be surface mounted unless otherwise noted on drawings. Fronts shall be of code gauge, furniture leveled steel having a flush door with flush hinges. Provide a chrome-plated flush combination lock and catch and directory card set in a frame. All locks shall be keyed alike. Fronts shall be finished in two coats of gray baked enamel. Directory cards shall be filled out to indicated circuitry with typed large case letters.

S. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Two pole circuit breakers shall have an internal common trip crossbar to provide simultaneous tripping.

T. There shall be two forms of visible trip indication. The breaker handle shall reside in a "TRIPPED" position between "ON" and "OFF." In addition, there shall be a VISI-TRIP indicator appearing in the clear window of the circuit breaker housing.

U. The exposed faceplates of all branch circuit breakers shall be flush with one another.

V. Lugs shall be UL listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 deg C rated wire, sized according to the 75 deg C temperature rating per NEC table 310-16. Branch breakers rated 30 amperes and below shall be UL listed to accept 60 deg C rated wire.

W. All panels shall be labeled inside their door with black stencil paint showing the name and operating voltage; e.g. "Lighting Panel LP-C, 120/208V."

X. Fronts shall be of code gauge, furniture leveled steel having a flush door with flush hinges. Fronts shall be finished in two coats of gray baked enamel.

Y. Breakers for three-phase service shall be quick-make, quick-break, trip indicating, with common trip on all multi-pole breakers, thermal magnetic action, including temperature compensation, bolted type, with toggle switching action to be independent of tripping action.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb, in conformance with NEMA PB 1.1.

B. Height: 6 ft. to top.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

E. Stub four (4) empty one-inch conduits to ceiling area out of each new panelboard for future use.

F. All panels shall be labeled inside their door with black stencil paint showing the name and operating voltage; e.g. "Lighting Panel LP-C, 120/208V."

G. Receive, inspect, handle, store and install Panelboards and accessories according to NEMA PB 1.1.

H. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.

I. Comply with NECA 1.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.
   4. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
      b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
      c. Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

Perform tests and inspections.

F. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section 260553 "Identification for Electrical Systems."

3.4 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance., measure load and make circuit changes.

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. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
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.

END OF SECTION 262417

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches

B. Receptacles

C. Device plates and box covers

1.2 RELATED SECTIONS

A. Division 26 Section 260533 – Raceways and Boxes for Electrical Systems

1.3 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices

B. NEMA WD 6 - Wiring Device Configurations

1.4 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. UTP: Unshielded twisted pair.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

B. Manufacturer's Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
2. Include instructions for storage, handling, protection, examination, preparation, operation, and installation of product.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: for wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

F. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

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 NFPA 70.

D. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

E. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.

F. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

1.7 COORDINATION

A. Receptacles for Equipment Furnished by Others: Match plug configurations.
1. Cord and Plug Sets: Match equipment requirements.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.9 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Provide two of each style, size, and finish wall plate.

C. Furnish under provisions of Section 01700.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:

1. Arrow-Hart & Hegeman series #1201 for single pole, #1203 for three way switches, etc., or approved equal by:

a. Hubbell
b. Bryant
c. Pass & Seymour
d. Eagle
e. Leviton

B. Description: NEMA WD 1, extra heavy-duty, AC only general-use snap switch.

C. Device Body: Ivory plastic with toggle handle. Verify color type with architect.

D. Indicator Light: Lighted handle type switch, red color handle.

E. Voltage Rating: 120-277 volts, AC.

F. Current Rating: 20 amperes, minimum.

G. Ratings: Match branch circuit and load characteristics.

H. Quiet operation Specification grade, non-mercury "Quiette" toggle switches.

I. Absolutely no despard switches shall be used unless otherwise specified or unless necessary due to building construction and then only if specifically approved by the Engineers.

J. Switches with pilot lights shall be equal to Hubbell catalog No. 1297, 20 ampere, quiet operation, specification grade.

2.2 RECEPTACLES

A. Manufacturers:

1. Hubbell #5362 or approved equal by:

a. Bryant
b. Pass & Seymour
c. Arrow Hart & Hegeman
d. Eagle
e. Leviton

B. Description: NEMA WD 1; extra heavy-duty duplex receptacle, rated 20A-120V-2P-3W-Grounding.

C. Device Body: Ivory plastic. Verify color type with architect.

D. Configuration: NEMA WD 6; type as specified and indicated.

E. Convenience Receptacle: Type 5-20R and UL 498.

F. GFCI Receptacle: Duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

1. GFI duplex receptacles shall be 20 ampere, 125 volt, Specification grade as manufactured by Pass and Seymour, Bryant, Arrow Hart & Hegeman, Leviton, or Eagle, equal to Hubbell #GF-5362. Interior device plates shall be Hubbell #526.

G. Specification grade.

H. All special outlets for copiers, etc. shall be equipped with approved receptacles to match cord caps on equipment furnished.

I. Weatherproof duplex receptacles shall be Hubbell Catalog No. GF-5362 receptacle with ground fault protection and Intermatic Catalog No. WP1030MC gray die cast metal mounting base with gray die cast metal weatherproof hinged cover with openings for two (2) cords or equal as manufactured by Pass and Seymour, Bryant, Eagle, Leviton, or Arrow-Hart and Hegeman.

2.3 WALL PLATES

A. Galvanized Steel Plates (Unfinished Areas). Verify type and color type with architect:

1. Appleton
2. Crouse-Hinds

B. Stainless Steel Cover Plate (Finished Areas). Verify type and color type with architect:

1. Pass & Seymour
2. Hubbell
3. Bryant
4. Arrow-Hart and Hegeman
5. Eagle
6. Leviton

C. Paint cover plates to match color of brick on building. Verify color type with architect.

D. All switch and receptacle plates shall be .040 stainless steel, 97,000 Series as manufactured by Pass and Seymour, Hubbell, Eagle, Bryant, Leviton, or Arrow-Hart and Hegeman.

E. All plates, whether single or gang type, shall be specifically suitable for the switches, receptacles, or outlet device, specified.

F. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Materials for Finished Spaces: 0.040-inch- (1-mm-) thick, satin-finished stainless steel.
3. Materials for Unfinished Spaces: Galvanized steel.

G. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.
1. Pass & Seymour
2. Hubbell
3. Bryant
4. Arrow-Hart and Hegeman
5. Eagle
6. Leviton

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and will be completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

D. Verify floor boxes are adjusted properly.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. 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 the 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. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

D. Device Installation:

1. 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.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Install products in accordance with manufacturer's instructions.
11. Install devices plumb and level.
12. Install switches with OFF position down.
13. Install GFCI receptacles in janitor closets and within 6" of sinks.
14. All switches and receptacles shall be flush-mounted unless otherwise noted.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install receptacles with grounding pole on bottom.

F. 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.

1. Install stainless steel plates on switch, receptacle, and blank outlets in finished areas.
2. Use jumbo size plates for outlets installed in masonry walls.
3. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

I. Install GFCI receptacles in toilet areas, janitor closets an within 6' of sinks.

J. Use jumbo size plates for outlets installed in masonry walls.

K. All switches and receptacles shall be flush-mounted unless otherwise noted.

L. Install products in accordance with manufacturer's instructions.

M. Install devices plumb and level.

N. Install switches with OFF position down.

O. Install receptacles with grounding pole on bottom.

P. Connect wiring device grounding terminal to branch circuit equipment grounding conductor. Isolated ground conductors shall serve only isolated ground receptacles.

Q. Install stainless steel plates on switch, receptacle, and blank outlets in finished areas.

R. Use jumbo size plates for outlets installed in masonry walls.

S. Install weatherproof covers for outdoor devices which are weatherproof with device in use.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 260533 to obtain mounting heights specified and indicated on Drawings.

B. Comply with Division 26 Section 260553 “Identification for Electrical Systems”.
   1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Perform tests and inspections and prepare test reports.
   1. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
   2. Test Instruments: use instruments that comply with UL 1436.

G. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
   3. Ground Impedence: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Fuses

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each fuse type. Include the following:
1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Descriptive data and time-current curves.
5. Let-through current curves for fuses with current limiting characteristics.
6. Coordination charts and tables and related data.

C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

D. Field test reports indicating and interpreting test results.

E. Operation and Maintenance Data: For fuses to include in operation, and maintenance manuals. In addition to items specified in Division 01 Section 017823 "Operation and Maintenance Data," include the following:
1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Single-Source Responsibility: All fuses shall be the product of a single manufacturer.

D. Comply with NEMA FU 1 for cartridge fuses.

E. Comply with UL 248-11 for plug fuses.

1.5 EXTRA MATERIALS

A. Furnish the following extra materials that match products installed, packaged with protective covering for storage, and with identification labels clearly describing contents.

B. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than one set of three of each type and size.

1.6 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fuses that may be incorporated in the work include, but are not limited to, the following:

1. Brush Fuses, Inc.
2. Bussmann Div., Cooper Industries, Inc.
3. Gould - Shawmut
4. Littlefuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1 nonrenewable cartridge fuse, class as specified or indicated, current rating as indicated, voltage rating consistent with circuit voltage.

B. Main Feeders: Class J time delay.

C. Motor Branch Circuits: Class RK1 time delay.

D. Other Branch Circuits: Class RK5 non-time delay.

E. In addition of fuses blown during construction and testing, a complete set of fuses shall be provided for all active fuse holders.

F. Main Service: Class L fast acting.

G. All main fuses rated above 600 amps shall be high-capacity, current-limiting fuses with a minimum short-circuit rating of 200,000 RMS amps; shall have characteristics to coordinate with other fuses as noted; and dimensions to mount in switchgear as specified. Fuses shall be Bussman “Hi-Cap”, type KRP-C.

H. All other fuses shall be dual element, current-limiting cartridge type and shall have a minimum short-circuit rating of 200,000 RMS amps. Fuses shall be Bussman “Low-Peak."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so that fuse ratings are readable without removing fuse.

B. Fuses for all circuits, motors, and other equipment shall be selected in ratings in accordance with the National Electrical Code, to provide a coordinated system of over-current protection. Thus in case of a fault or harmful overload, only the fuses nearest the fault or overloaded equipment shall open. Fuses selected for branch circuit protection of motors with other thermal overload protection shall not be rated at greater than 150% of full load motor current.

3.2 IDENTIFICATION

A. Install typewritten labels on the inside door of each fused switch to indicate fuse replacement information.

3.3 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1, time delay.
2. Feeders: Class J, time delay.
3. Control Circuits: Class CC, fast acting.
4. Other Branch Circuits: Class RK5, non-time delay.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 “General Requirements” Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible disconnect switches.
2. Nonfusible disconnect switches.
3. Enclosures.

1.3 REFERENCES

A. FS W-S-865 - Switch, Box, Surface-Mounted.

B. NEMA KS 1 - Enclosed Switches.

1.4 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.5 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include outline drawings with dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, equipment ratings for voltage, capacity, horsepower and short circuit, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.
2. Fuse Pullers: One for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Shall be quick-make, quick-break, load interrupter enclosed knife switch. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class R fuses. Provide blown fuse indicator.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Square D or equal by GTE Sylvania, General Electric Co., Siemens or Cutler Hammer/Westinghouse.

C. All switches shall be in a NEMA 1 enclosure when mounted indoors with a mechanical dual cover interlock.

D. Type HD, Heavy Duty, Single Throw, 240V or 600V ac as required, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, externally operable and lockable handle with capability to accept three padlocks, and interlocked with cover to prevent opening front cover with switch in closed (on) position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Compression type, suitable for number, size, and conductor material.
8. Accessory Control Power Voltage: Remote mounted and powered; 120V ac.

2.2 NONFUSIBLE SWITCHES

A. Shall be HD; quick-make, quick-break, load interrupter enclosed knife switch. Handle lockable in OFF position.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Square D or equal by GTE Sylvania, General Electric Co., Siemens or Cutler Hammer/Westinghouse.

C. All switches shall be in a NEMA 1 enclosure when mounted indoors with a mechanical dual cover interlock.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Compression type, suitable for number, size, and conductor material.
7. Accessory Control Power Voltage: Remote mounted and powered; 120V ac.

E. Type HD, Heavy Duty, Single Throw, 240V or 600V ac as required, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable externally operable and handle with capability to accept three padlocks, and interlocked with cover to prevent opening front cover with switch in closed (on) position.

2.3 ENCLOSURES

A. Enclosed Switches: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches with tops at uniform height unless otherwise indicated.

B. Field set adjustable rating plugs.

C. Install disconnect switches where indicated on drawings.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 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 inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 “General Requirements” Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual motor starters.

1.3 REFERENCES

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

B. NEMA PB 1.1 - Instructions for Safe Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or less.

C. NEMA KS 1 - Knife Switches.

D. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

E. NEMA PB 1 - Panelboards.

1.4 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

1.5 SUBMITTALS

A. Product Data: For each type of enclosed controller, relays, pilot devices, switches, and overcurrent protective devices. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Operation and Maintenance Data: For enclosed controllers to include in operation, and maintenance manuals. In addition to items specified in Division 01 Section 017823 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.
5. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

E. Field quality-control reports.

F. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

G. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

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. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller.

C. Handle in accordance with manufacturer's written instructions.

D. Deliver in 60-inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.

E. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary utilities.
3. Do not proceed with interruption of electrical systems without Owner's written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D Co. or comparable product by one of the following:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Rockwell Automation, Inc.; Allen-Bradley brand.
    d. Siemens Energy & Automation, Inc.
    e. GTE Sylvania.

2. Configuration: Nonreversing.
3. Surface mounting.
4. Red pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" manual toggle type or push-button action; marked to show whether unit is off, on, or tripped.

1. Unless otherwise specified, all motor starters for motors less than 1 HP shall be 120 volt, single phase, motor starting switches with thermal overloads. Starters shall be installed in flush switch boxes with coverplates identical appearance to lighting switches in all finished areas. Provide pilot lights for all motor starters.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Square D Co. 2510 or comparable product by one of the following:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Rockwell Automation, Inc.; Allen-Bradley brand.
    d. Siemens Energy & Automation, Inc.

3. Configuration: Nonreversing.
4. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; melting alloy type.
5. Surface mounting.
6. Red pilot light.

7. Where manual starters are mounted flush in a wall (finished areas), provide a stainless steel plate, all other enclosures shall be NEMA Type I.

2.2 MOTORS

A. All electric motors for equipment supplied elsewhere in these specifications shall conform to the latest revision of NEMA Motor and General Standards.

B. Unless otherwise noted, all motors will be provided and installed by other Trades for final connections by the Contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive starters, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

3.2 IDENTIFICATION

A. Identify starters, components, and control wiring. Comply with requirements for identification specified in Division 26 Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.

3.3 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 inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with hew units and retest.

2. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance contractor to perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3.
4. Test continuity of each circuit.
5. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
6. Test each motor for proper phase rotation.
7. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

END OF SECTION 262913

SECTION 265100 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior lighting fixtures, lamps, and drivers.
2. Luminaire accessories.
3. Lighting fixture supports.
4. These specifications and the accompanying plans contemplate the furnishing of all labor and material necessary for a complete installation of fixtures, electrical components, wiring and lamps for lighting outlets shown on drawings. These fixtures shall be complete in every detail properly wired and connected with circuits supplying same.
5. Exit signs.
6. Contractor shall verify ceiling conditions and furnish appropriate mounting details for each luminaire. Where work of this section is to be flush or concealed, install it to assure that it does not project beyond the finished lines of floors, ceilings or walls, Contractor shall verify voltages.
7. Lighting contactors.
8. Timers.
9. Photo cells.

1.2 RELATED SECTIONS

A. Division 26 Section 260553 “Raceway and Boxes for Electrical Systems”

B. Division 26 Section 265200 “Lighting Control Systems”

C. Division 26 Section 262726 “Wiring Devices for Switches”

1.3 REFERENCES

A. FS W-L-305 Light Set, General Illumination (Emergency or Auxiliary).

B. ANSI/NFPA 101 – Life Safety Code.

C. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

D. ANSI/NFPA 70 - National Electrical Code, current edition.

1.4 DEFINITIONS

A. Luminaire: Complete lighting fixture, including driver housing if provided.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. Lumen: Measured output of lamp and luminaire, or both.

E. LER: Luminaire efficacy rating.

1.5 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, ratings and the following:

1. Physical description of lighting fixture including dimensions.
2. Driver.
3. Energy-efficiency data.
4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, drivers, and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Data: Provide dimensions, ratings, and performance data.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. "Equal" submittals are subject to "review and acceptance" by the Engineers.

F. Before fixtures are fabricated or ordered, this Contractor shall submit cuts and specifications for each fixture type for approval by the Engineer.

G. Field quality-control reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

I. Warranty: Sample of special warranty.

J. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

K. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting fixtures.
2. Suspended ceiling components.

3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
4. Structural members to which suspension systems for lighting fixtures will be attached.
5. Other items in finished ceiling including the following:
   a. Air outlets and inlets.
   b. Sprinklers.

L. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

M. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:
1. Lamps and drivers, installed.
2. Cords and plugs.
3. Pendant support system.

N. Installation instructions.

O. During the construction period, no substitutions shall be considered unless compelling reasons are given, such as a specified product no longer being available. However, if Contractor has failed to follow the schedule presented under the Paragraph titled “Submittal Schedule” below, no substitutions will be allowed based on inability of specified manufacturer to meet delivery schedule, and the Contractor shall provide luminaries exactly as specified without delay to the project and without additional cost to Owner.

P. Submitted products shall meet all aspects of the performance specification, or clearly indicate any variations, with a description of how the proposed product meets or exceeds the required performance.

Q. Luminaries or other materials shall not be shipped, stored or installed into the work unless prior approval has been received, based upon the submittal shop drawings, samples, catalogue cuts, test data, certificates or other material submitted for approval. Make modifications to luminaries in accordance with Architect’s comments concerning submittals, as a part of the work of this section.

R. Owner’s Manual: Prior to final inspection, the Contractor shall provide a complete set of operating and maintenance manuals.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations of each luminaire.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01700.

B. Maintenance Data: Include replacement parts list.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Conform to requirements of NFPA 101.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

D. All lighting fixtures shall comply with all requirements of State Codes and rules and regulations, and the National Electrical Code.

E. All plastic fixture lenses and diffusers shall comply with all State and local codes and requirements. Plastic used in lighting fixtures shall conform to the latest revision of Bulletin No. 412, "Tentative Guidelines for the Use of Formed Plastic Materials," and the State Fire Safety Board Requirements. All plastic shall be virgin acrylic.

PART 2 - PRODUCTS

2.1 LUMINARIES

A. Furnish products as specified in schedule.

B. Install drivers, lamps, and specified accessories at factory.

C. These specifications and the accompanying plans contemplate the furnishing of all labor and material necessary for a complete installation of fixtures and lamps for lighting outlets shown on drawings. These fixtures shall be complete in every detail properly wired and connected with circuits supplying same.

D. Unless otherwise noted on the drawings, the lenses of recessed LED fixtures shall be prismatic acrylic, minimum 0.125 inches thick.

2.2 DRIVERS

A. LED Driver:

1. Sylvania, Westinghouse, General Electric or Philips.
2. Provide with a Bussman GLR fuse in an HLR holder, of ampere rating as required for individual LED lamp load.
3. Description: ANSI C82.1, rapid start, high power factor type, low wattage, electronic integrated circuit driver, thermally protected, "A" sound rating, maximum 10% THD (total harmonic distortion).
4. Provide driver suitable for lamps specified.
5. Source Quality Control: Certify driver design and construction by Certified Driver Manufacturers, Inc. and each driver shall bear the CBM certified ETL label together with all pertinent characteristic data.
6. 120 volt.

7. Should any driver develop any noticeable hum or become inoperative during the Contract Guarantee period, then the driver and fuse shall be replaced in the fixture and connected for complete operation at no additional cost to the Owner.

2.3 LAMPS

A. LED Lamps shall be Sylvania or alternative manufacturer listed below:

1. Westinghouse
2. General Electric
3. Phillips

B. Recessed LED fixtures shall have automatic thermal cut out protection.

C. Provide line fusing for all LED drivers.

2.4 EXIT LIGHTING AND EMERGENCY LIGHTING SYSTEM

A. The Respective Contractor shall provide and install a combined exit lighting system and emergency night lighting system as specified herein and as indicated on drawings.

B. Provide illuminated directional exit signs and emergency lights as indicated on the Fixture Schedule.

C. Conductors used to feed this system shall be installed in conduit used exclusively for this system.

2.5 EXTERIOR LIGHTING

A. Exterior lighting, including building, sidewalk, flag pole and parking lot lighting shall be of type indicated and as specified, controlled from lighting contactors.

B. Control of lighting contactors shall be with time clocks and photocells as indicated on drawings. Contactors shall have a hand-off-auto selector switch in cover.

2.6 LIGHTING CONTACTORS

A. Shall be rated 600 volts, AC, single-throw, electrically operated, mechanically held permanent magnetic latch type with operating coil for 120 o 277 volts as noted on drawings, with hand-off auto controls and with number of poles as required or as indicated on the drawings. Ampere rating for lighting contactor shall be as required or as called for on the drawings. Contactor shall be Square D Class 8903 or Engineer approved equal.

2.7 PHOTOELECTRIC CONTROLLERS

A. Shall be weatherproof for outside mounting. Controller shall be SPDT with contact arrangements compatible with type of contactor provided, and shall operate on 120 volt, 60 Hertz power, rated a minimum of 1000 watts and shall have preset adjustable turn-on and turn-off points from 1.0-12.0 foot-candles. Time delay feature shall be included to prevent switching of lights due to transient lighting changes. Controller shall be equipped with 1/2" pipe-thread and shall be Intermatic No. K1811 or Engineer approved equal.

2.8 TIME CLOCKS

A. Shall be rated 20 ampere inductive at 120volts, single pole double throw, electronic programmable type, four (4) circuit, minimum of 1000 set points, user selectable override, astronomical switching, individual

programming per circuit, up to 99 different holidays, fully automatic daylight savings time, and shall include 7-day, 24-hour dial adjustable, and with NEMA1 enclosure for surface mounting. Timer shall be Intermatic Cat. #ET70415CR or Engineer approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaries.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Locate recessed ceiling luminaries as indicated on reflected ceiling plan and support independent of ceiling grid with two safety wires minimum on diagonally opposite corners of fixtures. Do not daisy chain fixtures from supports.

B. Fixture supports shall be of angle iron, channel iron, or rod supports, and shall be sufficiently strong to ensure that the fixtures never fall down.

C. Support luminaries independent of ceiling framing.

D. After all fixtures and lamps are installed, a lighting test shall be made in the presence of the Engineer, and any defects in control or operation found at this time shall be corrected by the Contractor at his own expense.

E. An individual feed with ground conductor shall be provided from a junction box to each lighting fixture. Lighting fixtures shall not be daisy-chained.

F. Bond products and metal accessories to branch circuit equipment grounding conductor. Do not use conduit as fixture ground.

G. Install specified lamps in each luminaire, emergency lighting unit and exit sign.

H. Drops to recessed lighting fixtures may be flexible metallic conduit (maximum of 6’-0” long). Fixtures may be pre-whipped. Fixtures shall be provided with sufficient length to permit removal and lowering of the fixtures 12" below the ceiling.

I. Install in accordance with manufacturer’s instructions, support with channel, clamps, rods and hardware to ensure safe and stable condition.

J. Install recessed luminaries using accessories and firestopping materials to meet regulatory requirements for fire rating.

K. Install clips to secure recessed grid-supported luminaries in place.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Install accessories furnished with each luminaire.

N. Connect luminaires to branch circuit outlets provided under Section 260533 using flexible conduit or pre-whips wiring.

O. When completed job is turned over to the Owner all lighting fixtures shall be clean.

P. All lighting fixtures hanging from ceiling, fixture channel or conduit system shall be hung in a neat, workmanlike manner with reflectors level, stems in vertical alignment, joints in outlet boxes or other enclosures soldered, taped and/or well insulated with approved connectors, and all finger marks or other smudges removed. Nameplates and labels shall be concealed from view.

Q. Sizes of junction boxes, number of wires in junction boxes and wire temperature limitations shall be in strict conformance with all code requirements.

R. Lighting fixtures shall be located for symmetrical, even illumination. Due to the many ducts, mechanical piping and ceiling construction, a fabricated steel hanging arrangement may be required under ducts or piping, and this Contractor shall arrange to install outlets, conduits and brackets for support of lighting in the field at no increase in Contract cost. Electrical Trades shall verify the location of all lighting fixtures with Architectural Reflected Ceiling Plans and/or Superintendent in conjunction with other Trades installations prior to installing fixtures. Electrical Trades shall coordinate and work closely with the other Trades to insure against interferences and improper installation of the lighting system.

S. Install surface mounted luminaries and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement. Exit signs shall be centered in ceiling tile, support directly from building structure.

T. Recessed lighting fixtures shall be supported independently of the ceiling grid system using two safety wires minimum on diagonally opposite corners of the fixtures.

U. Install wall mounted luminairies, emergency lighting units and exit signs at height as indicated on architectural elevations.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

B. After all fixtures and lamps are installed, a lighting test shall be made in the presence of the Engineer, and any defects in control or operation found at this time shall be corrected by the Contractor at his own expense.

3.4 ADJUSTING

A. Adjust Work under provisions of Section 01700.

B. Relamp luminaires that have failed lamps at Substantial Completion.

C. Adjust exit sign directional arrows as indicated.

3.5 CLEANING

A. Clean Work under provisions of Section 01700.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage with manufactured supplied materials.

F. When complete job is turned over to the Owner, all lighting fixtures shall be clean.

3.6 DEMONSTRATION

A. Provide minimum of two hours demonstration of luminaire operation.

END OF SECTION 265100

SECTION 265200 - LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

1.2 SYSTEM DESCRIPTION

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is the intent of this section to provide an integrated, energy saving, lighting control system including occupancy sensors and power packs, etc. from a single supplier. Contractor is responsible for confirming that the power packs and sensors interoperate as a single system.

B. Lighting control system shall be digital and consist of a master lighting control panel with up to 16 individual relays, remote lighting control panel with up to 16 individual relays in each panel, digital switches and digital interface cards. All system components shall connect in a “daisy chain” style configuration and be controlled via category 5 patch cable with RJ45 connectors, providing real-time two-way communication with each system component. Analog systems are not acceptable. All cables supplied by contractor.

C. Contractor’s work to include all labor, materials, tools, appliances, control hardware, power packs, sensors, wire, junction boxes and equipment necessary for an incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as describe herein.

D. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

E. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

F. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with specifications. The supplier obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment, which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner’s acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Manufacturer shall be ISO 9001 certified.

B. Comply with NEC, NEMA, and FCC Emission requirements for Class A applications.

C. UL Approvals: Sensors and accessory devices are to be UL listed under UL 916 Energy Management Equipment.

1.4 SUBMITTALS

A. Submit manufacturer's data on lighting control system and components including shop drawings, detailed point to point wiring diagrams, and floor plans showing occupancy and sensor locations. Provide typical mounting details for occupancy sensors for this application.

B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

C. Submit any interconnection diagrams per major subsystem showing proper wiring.

D. Submit standard catalog literature, which includes performance specifications indicating compliance to the specifications.

E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

F. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

G. Shop Drawings: Submit drawings of lighting control system and accessories including, but not necessarily limited to, relay panels, switches, DTC , photocells and other interfaces. Drawings shall indicate exact location and programming of each device. Indicate all time schedules and switch button engraving.

1.5 MANUFACTURERS

A. The basis of the Lighting Control System design is Lighting Control and Design (LC&D), Glendale, CA (800-345- 4448) or approved equal. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the consultant.

1.6 SYSTEM OPERATION

A. It shall be the contractor’s responsibility to make all proper adjustments to assure Owner’s satisfaction with the occupancy system.

B. Factory Commissioning – It shall be the manufacturer’s responsibility to verify all proper adjustments and train Owner’s personnel to ensure Owner’s satisfaction with the occupancy system.

1.7 EQUIPMENT QUALIFICATION

A. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be U.L. listed, offer a five (5) warranty and meet all state and local applicable code requirements.

C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnished products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.9 EXTRA MATERIALS

A. Furnish under provisions of Section 01700.

B. Provide two (2) of each style and finish wall plate.

PART 2 - PRODUCTS

2.1 OCCUPANCY SENSORS AND POWER PACKS

A. Occupancy Sensors

1. All products shall be Lighting Control & Design product numbers or equal and will integrate fully with the project specifications.
2. Lighting control system shall consist of master and remote panel(s) controlled by a 32-channel digital time clock (DTC) that controls and programs the entire lighting control system. The DTC shall supply all time functions and accept other inputs. The DTC shall accept control locally using built in button prompts and use of an 8 line 21-letter display, from a computer, modem, Ethernet or internet. All commands shall be in plain English. Help pages shall display on the DTC screen.
3. Relay panels shall be pre-wired, pre-assembled, preprogrammed and listed to UL 916 (normal) or ETL listed to UL924 (emergency). Panels shall be provided with dual voltage power supply.
4. Standard relays shall have normally closed latching (NCL) contacts UL listed 30A at 277VAC and 20A at 347VAC for ballast/HID and 20A tungsten at 120VAC with an 18,000A SCCR at 277VAC. 250,000 operations at 30AMP fully loaded. No exceptions. Optional 480VAC 2-pole relay shall be available.
5. Relay panel electronics shall provide current visual status and control of each relay or zone. All system control electronics shall store programming in a non-volatile memory and provide 10 year battery back up for time of day.
6. All units shall be white.
7. Passive infrared sensors shall:

    a. Utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
    b. Provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).
    c. Have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

8. Dual technology sensors shall:

    a. Be either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas.

b. Consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

9. Ultrasonic sensors shall:

a. Utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.
b. Have and ultrasonic operating frequency that is crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

10. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
11. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
12. When specified, sensors shall utilize SmartSet™ technology for automatically adjustable time delay and sensitivity settings.
13. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
14. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
15. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
16. All switches shall communicate via RS 485, CAT 5 patch cable with RJ45 connectors. Contact closure style switches are not acceptable. Any switch button function shall be able to be changed locally (at the DTC or a PC) or remotely, via modem, Ethernet or internet. Refer to single line diagram for wiring details. Switches which cannot be programmed remotely shall not be acceptable.
17. Photocell, exterior (PCO) or interior (PCI), shall provide readout on the DTC screen in number values analogous to foot-candles. Each photocell shall provide a minimum of 14 trigger points. Each trigger can be programmed to control any relay or zone. Each trigger shall be set through DTC, locally or remotely. Photocells that require the use of set screws or manual adjustments at the photocell control card shall not be acceptable.
18. Lighting control system interfaces to include a dry contact input interface, BMS interface, dimming system interface, Ethernet/internet interface and an interface to smartbreaker panel boards. Verify and install only those interfaces indicated on the plans.
19. Standard lighting control system software, pre-installed into the DTC, shall consist of and use standard graphical management software (GMS) pages. GMS software shall provide via local or remote PC a visual representation of each device on the bus, show real time status and the ability to change the status of any individual device, relay or zone. Optional software that accepts job specific graphics shall be available. No exceptions.

B. CIRCUIT CONTROL HARDWARE – (POWER PACKS)

1. Control Units - For ease of mounting, installation and future service, control units shall be able to externally mount through a 1/2-inch knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
2. Relay contacts shall have ratings of:

a. 13A - 120 VAC Tungsten
b. 20A - 120 VAC Ballast
c. 20A - 277 VAC Ballast

d. 20A – 347 VAC Ballast

3. Mount concealed above accessible ceilings in finished areas.
4. Power pack shall be a self-contained transformer and relay module measuring 3.69" x 2.33" x 1.36"
5. Power pack shall have primary universal voltage inputs of 100-277VAC, 60Hz.
6. Power pack shall have dry contacts capable of switching 20 amp ballast and incandescent load @120 VAC, 60Hz; 20 amp ballast @ 277 VAC, 60Hz; 1 HP @ 122-277 VAC, 60Hz.
7. Power pack shall provide a 24 VDC, 150mA output.
8. Power pack shall provide overload protection. A momentary or continuous short of any of the control wires will not damage the device.
9. Power pack shall provide Zero Arc Point Switching to protect from the effects of inrush current and increase product life.
10. Power pack shall be capable of parallel wiring without regard to AC phases on primary.
11. Power pack can be used as a stand alone, low voltage switch, or can be wired to sensor for auto control.
12. Power an auxiliary relay packs shall be suitable for use in plenum applications.
13. For ease and speed of installation, power and auxiliary relay pack shall have ½" snap-in nipple for ½" knockouts and shall mount on the outside or inside of enclosure.
14. Power and auxiliary relay packs shall have a five (5) year warranty.
15. Power and auxiliary relay packs shall be UL and CUL listed.

C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

1. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

D. Wall Switch Sensors
1. Sensor shall have a microprocessor and utilize IntelliDAPT ™ technology to optimized the sensor's behavior to fit occupant usage patterns and adjust sensitivity and time delay to changing conditions.
2. Sensor shall not require any manual adjustment at the time of installation or during operation.
3. Sensor shall adapt automatically to changing room conditions.
4. Sensor shall be available in passive infrared only, ultrasonic only, or multi-tech (passive infrared and ultrasonic) versions and shall utilize that technology to detect motion. Sensor shall not react to acoustic noise or ambient sound.
5. Sensor's microprocessor shall monitor PIR background levels and/or ultrasonic frequency changes and automatically make corresponding adjustments.
6. Sensors utilizing passive infrared detection technology shall incorporate a dual element pyrometer and 12-element cylindrical impact resistant Rhino Tuff ™ Fresnel lens.
7. Sensors utilizing ultrasonic detection shall have an ultrasonic frequency of 40 kHz.
8. Sensor shall provide either 1000 sq. ft. or 400 sq. ft. with 180 degree area of coverage.
9. Sensor shall operate at universal voltages 100 – 277VAC; 50/60Hz, with each relay able to operate on a different voltage.
10. Sensor shall have no minimum load requirement and shall be capable of switching 0 to 1000W Ballast or 1/6HP @ 100/120VAC, 50/60 Hz.
11. Sensor shall have line and load control wires plus a ground wire for safety. Sensor shall not require a neutral.
12. Sensor shall be available with two relays capable of simultaneously controlling independent lighting loads or circuits. The secondary relay is isolated, allowing for two-circuit control.
13. Sensor shall have automatic-ON or manual-ON operation adjustable with DIP switch.
14. Sensor shall have a user accessible ON/OFF control for each circuit.
15. When the sensor is in the 5-sec test time out mode, depressing the push button reverts the unit to standard time out mode.
16. Sensor shall retain all learned adjustments and programmed modes of operation even after power loss.
17. Sensor shall close the relay at zero crossing to protect the contacts.

18. Sensor shall recognize the lighting turning off exactly 1 timeout period as a false on. In response to the second false on, sensitivity settings are adjusted accordingly.
19. Sensor shall automatically determine and calibrate the ambient light level set point (10 -500 fc) when put into daylight mode.
20. Sensor shall have a Supersaver ™ mode which turns lights off during periods of occupancy if ambient light levels increase sufficiently to illuminate the area.
21. Sensor shall have a hallway algorithm, that wen enabled reduces false tripping of the lights associated with hallway traffic outside the room where the sensor is controlling the lights.
22. Sensor shall have an adaptive reset switch, that when enabled resets the sensor's adaptive timer and sensitivity settings.
23. Sensor shall have configuration switches that are only accessible with fascia cover removed.
24. Sensor shall have a safety air gap disconnect switch.
25. Sensor shall have an automatic timer mode of 4-30 minutes which self-adjusts based on occupancy.
26. Sensor shall have a fixed timer mode of 4, 8, 15 and 30 minutes.
27. Sensor shall have a 5-sec time out test mode, which reverts to standard timeout after pressing any button or automatically after one hour.
28. Sensor shall have a minimum 4-min time out (standard).
29. Sensor shall be ETL listed (Conforms to UL STD 508 Certified to CAN/CSA STD C22.2 NO.14).
30. Sensor shall have a 5-year warranty.
31. Sensor shall use a standard Decorator-style trim plate.
32. Sensor shall be available in White, Ivory, Lt. Almond, Gray or Black.

E. Ceiling and Wall Sensors
1. Sensor shall have a microprocessor and utilized IntelliDAPT ™ technology to optimize the sensor behavior to fit occupant usage patterns and adjust sensitivity and time delay to changing conditions.
2. Sensor shall not require any manual adjustment at the time of installation or during operation.
3. Sensor shall adapt automatically to changing room conditions.
4. Sensor shall utilize either passive infrared, ultrasonic, or both passive infrared and ultrasonic technology to detect motion. Sensor shall not react to noise or ambient sound.
5. Sensor's microprocessor shall monitor PIR background levels and automatically make corresponding adjustments.
6. Sensor shall incorporate a dual element pyrometer and 12-element cylindrical Fresnel lens.
7. Sensor shall be provided with a variety of mask inserts for PIR rejection to prevent false tripping.
8. Sensor's microprocessor shall monitor ultrasonic frequency changes and automatically make corresponding adjustments.
9. Sensor's microprocessor shall automatically adapt to a continuous airflow situation.
10. Sensor shall have an ultrasonic frequency of 32kHz or 40kHz.
11. Sensor coverage shall range from 0 to 2000 sq. ft. depending on model.
12. Sensor shall be available with either a 110 degree, 180 degree, or 360 degree field of view.
13. Sensor shall recognize, as a false on, the failure to detect motion 6 seconds after motion is detected initially (turning on the lighting). The sensor shall decrease the sensitivity in response to the false on.
14. Sensor shall feature an 8-second time out install test mode, which will automatically revert to standard time out one hour after being put into test mode.
15. Sensor shall have manual controls and override switches to force manual adjustments.
16. Sensor shall have controls behind a cover to resist tampering. All controls shall be accessible from the front of the sensor.
17. Sensor shall have timer that can be adjusted manually from 8 to 30 minutes.
18. Sensor sensitivity shall be adjustable from 0% to 100%.
19. Sensor shall have a control knob that sets the minimum setting for the timer in automatic mode.
20. Sensor shall have control knobs for setting the initial automatic sensitivity adjustments.
21. Sensor shall have a switch to restore factory settings.
22. Sensor shall have real time motion indicator LED's visible from the front of the unit. Red = Infrared, Green = Ultrasonic.
23. Sensor shall be ceiling or wall mounted.
24. Sensor shall accept Class 2 wiring.

25. Sensor shall be UL and cUL listed.
26. Sensor shall have a standard 5-year warranty.
27. Sensor shall be available in White.

PART 3 - EXECUTION

3.1 SUPPORT SERVICES

A. System Startup

1. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all system components. The startup requirement is intended to verify:

   a. That all occupancy sensors are applied as intended by the factory and the contract documents.
   b. The occupancy sensors are operating within the manufacturers specifications
   c. The sensors act as a complete and operational system to meet the design intent.

2. Manufacturer to provide a written statement verifying that the system meets the above requirements.

3. Start Up: EC shall contact LC&D at least 7 days before turnover of project. LC&D will remotely dial into the lighting control system, run diagnostics and confirm system programming. EC shall be available at the time of dial in to perform any corrections required by LC&D. EC is responsible for coordinating with GC and the Owner, the installation of a dedicated telephone line or a shared phone line with A/B switch. Phone jack shall be mounted within 12" of master LCP. Label jack with phone number. EC shall connect phone line from jack to master LCP. No exceptions.

4. Telephone factory dial-up support shall be available at no additional cost to the EC or Owner both during and after the 3 year warranty period. Factory shall preprogram the lighting control system per plans and approved submittal. The lighting control manufacturer, at no added cost, shall provide additional programming via modem as required by the EC or Owner for the operational life of the system. Manufacturer warrants that the DTC software can be upgraded and monitored remotely. No exceptions.

B. Training

1. Manufacturer shall provide factory authorized application engineer to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and power packs.

C. Documentation

1. Manufacturer shall provide system documentation including:

   a. Reflected ceiling plans showing each occupancy sensor location.
   b. System 1-line showing all number and type of switches and sensors.
   c. Typical wiring diagrams for each component.

2. The manufacturer will certify that the products will meet the product specifications and local energy codes. If any additional equipment is required to meet the coverage patterns or local energy codes, the manufacturer will provide the additional equipment at no cost to the Owner.

3.2 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and will be completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.3 PREPARATION

A. Provide extension rings to bring outlets flush with finished surfaces.

B. Clean debris from outlet boxes.

3.4 INSTALLATION

A. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms, which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at Owner's facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

D. Install products in accordance with manufacturer's instruction.

E. Install devices plumb and level.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes to obtain mounting heights specified and indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Test each receptacle device for proper operation.

C. Verify that each receptacle device is energized.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.8 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system. This service is provided at an additional cost.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine-tuning the factory authorized technician shall provide the proper training to the Owner's personnel in the adjustment and maintenance of the sensors.

END OF SECTION 265200

SECTION 266000 - MOUNTING HEIGHTS OF EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of Section 260500, Common Work Results for Electrical, bound herein, form a part of this contractors work and shall be considered a part of this Section.

1.2 SECTION INCLUDES

A. Listed mounting heights for various types of electrical devices.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 INSTALLATION

A. In general, mounting heights above finished floor to the center-line of electrical boxes and equipment shall be as follows unless otherwise indicated on the drawings:

1.	Receptacles	1'-6" (unless otherwise noted), flush mounted
2.	Lighting, Power and Receptacle Panels	4'-0" to center of panel providing bottom of cabinet is not less than 1'-0" above floor and top not above 6'-0"
3.	Lighting Switches	4'-0", flush mounted
4.	Dimmer Switches	4’-0”
5.	Disconnect Switches	4’-0”
6.	Wall Occupancy Sensors	4’-0’, flush mounted
7.	Starters	4’-0”
8.	Telephone/Data Outlets for Desk Mounted Phones	1’-6”, flush mounted
9.	Lighting Contactors	4'-0”
10.	Wall Telephone Outlets	4’-0”, flush mounted
11.	Bracket Exit Lighting Fixtures	7’-6” with 8’-0” ceiling; 8’-0” with 9’-0” and higher ceiling
12.	Photo Cells	On Roof
13.	Timers	4’-0”

14.	TV Outlets	7’-0” U.O.N.

END OF SECTION 266000

SECTION 266001 - ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Supplemental Provisions, Sections of Division 1, General Requirements and the requirements of Section 260500, Common Work Results for Electrical, bound herein, form a part of this Contractor's Work and shall be considered a part of this section.

1.2 GENERAL NOTE

A. The following section is based on NETA Standard ATS, Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems, which is a copyrighted publication of the International Electrical Testing Association 1718 Connecticut Ave., NW, Suite 310, Washington, DC 20009.

1.3 GENERAL REQUIREMENTS

A. The Contractor shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.

B. It is the intent of these tests to assure that all electrical equipment, both contractor and owner supplied, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

C. The tests and inspections shall determine suitability for energization.

1.4 APPLICABLE CODES, STANDARDS AND REFERENCES

A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

1. National Electrical Code – NEC, current edition.
2. National Electrical Manufacturer's Association - NEMA
3. American Society for Testing and Materials - ASTM
4. Institute of Electrical and Electronic Engineers - IEEE
5. International Electrical Testing Association - NETA
6. American National Standards Institute - ANSI
    a. ANSI C2: National Electrical Safety Code
    b. ANSI Z244-1: American National Standard for Personnel Protection
7. State and Local Codes and Ordinances
8. Insulated Cable Engineers Association - ICEA
9. Association of Edison Illuminating Companies - AEIC
10. Occupational Safety and Health Administration
    a. OSHA Part 1910: Subpart S, 1910.308
    b. OSHA Part 1926: Subpart V, 1926.950 through 1926.960

11. National Fire Protection Association - NFPA

    a. ANSI/NFPA 70B: Electrical Equipment Maintenance
    b. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
    c. ANSI/NFPA 70: National Electrical Code
    d. ANSI/NFPA 78: Lightning Protection Code
    e. ANSI/NFPA 101: Life Safety Code

B. All inspections and tests shall utilize the following references:

1. Project Design Specifications
2. Project Design Drawings
3. Manufacturer's instruction manuals applicable to each particular apparatus

1.5 DIVISION OF RESPONSIBILITY

A. The contractor shall perform routine insulation resistance and continuity tests for all equipment prior to and in addition to tests specified herein.

B. The Contractor shall notify the Owner's Representative prior to commencement of any testing.

C. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported.

D. The contractor shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.

1.6 GENERAL TESTING REQUIREMENTS

A. Test Report: The test report shall include the following:

1. Summary of project.
2. Description of equipment tested.
3. Description of test.
4. Test results.
5. Conclusions and recommendations.
6. Appendix, including appropriate test forms.
7. Identification of test equipment used.
8. Signature of responsible test organization authority.

B. Furnish five (5) copies of the complete report to the Owner's Representative within thirty days of completion of all tests.

C. Safety and Precautions: Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act of 1970-OSHA
2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4
3. Applicable State and Local safety operating procedures
4. Owner's safety practices
5. National Fire Protection Association - NFPA 70E
6. ANSI Z244.1 American National Standards for Personnel Protection

D. All tests shall be performed with apparatus de-energized except where otherwise specifically required elsewhere in these specifications.

E. The Contractor shall have a designated safety representative on the project to supervise operations with respect to safety.

1.7 SPECIFIC WORK SCOPE

A. The following items of equipment shall be tested in accordance with the ***INSPECTION AND TEST PROCEDURES*** hereinafter specified.

1. Switches
2. Circuit breakers and panelboards
3. Grounding system
4. Lighting and receptacle panelboards
5. Starters
6. Disconnect switches

B. The following systems shall be operationally tested in accordance with SYSTEM FUNCTIONAL TESTS hereinafter specified.

1. Lighting system.
2. Audio visual system.
3. Lighting control system.

PART 2 - MATERIALS

2.1 TEST EQUIPMENT

A. All devices and materials to perform the inspection and maintenance must be obtained prior to commencing the work.

1. All instruments required must be available and in proper operating condition.
2. All disposable materials such as solvents, rags, and brushes required must be provided.
3. All equipment handling devices such as cranes, vehicles, chain falls, and other lifting equipment must be available or scheduled.
4. All instruction books, calibration curves, or other printed material to cover the electric devices must be available.
5. Data sheets to record all test results must be available before the work is started.

PART 3 - EXECUTION

3.1 INSPECTION AND TEST PROCEDURES

A. Cable: Cables - Low Voltage - 600V Maximum

1. Visual and Mechanical Inspection:

a. Inspect cables for physical damage and proper connection in accordance with single line diagram.
b. Test cable mechanical connections to manufacturer's recommended values with a calibrated torque wrench. In the absence of manufacturer's data use Table 3.2.
c. Check cable color coding with applicable specifications and National Electrical Code standards, 310-12.
d. Green - Ground – Required.
e. White or Gray – Required.

2. Electrical Tests:

a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.
b. Perform continuity test to insure proper cable connection.

3. Test Values:

a. Minimum insulation resistance values shall be not less than two megohms.

B. Circuit Breakers and Panelboards: Circuit Breakers - Low Voltage Molded Case

1. Visual and Mechanical Inspection:

a. Circuit breaker shall be checked for proper mounting, conductor size and feeder designation.
b. Operate circuit breaker to ensure smooth operation.
c. Inspect case for cracks or other defects.
d. Check tightness of connections with calibrated torque wrench. Refer to manufacturer's instructions or Table 3.2 for proper torque levels.

C. Metering and Instrumentation:

1. Visual and Mechanical Inspection:

a. Examine all devices for broken parts, indication of shipping damage and wire connection tightness.
b. Verify meter connections in accordance with appropriate diagrams.

2. Electrical Tests:

a. Check calibration of meters at all cardinal points.
b. Verify all instrument multipliers.

D. Grounding Systems:

1. Visual and Mechanical Inspection:

a. Inspect ground system for compliance with plans and specifications.

3.2 SYSTEM FUNCTIONAL TESTS

TABLE 3.1

Insulation Resistance Tests
On Electrical Apparatus and Systems

Voltage Rating	Minimum Test Voltage	Recommended Minimum Insulation Resistance In Megohms
250	500 VDC	25
600	1,000 VDC	100
5,000	2,500 VDC	1,000
15,000	2,500 VDC	5,000
25,000	5,000 VDC	20,000

TABLE 3.2

U.S. Standard

Bolt Torques for Bus Connections

Heat Treated Steel - Cadmium or Zinc Plated

GRADE	SAE 1&2	SAE 5	SAE 6	SAE 8
MINIMUM TENSILE (P.S.I.)	64K	105K	133K	150K
BOLT DIAMETER		TORQUE (FOOT POUNDS)		
1/4	4.0	5.6	8.0	8.4
5/16	7.2	11.2	15.2	17.6
3/8	12.0	20.0	27.2	29.6
7/16	19.2	32.0	44.0	48.0
1/2	29.6	48.0	68.0	73.6
9/16	42.4	70.4	96.0	105.6
5/8	59.2	96.0	133.6	144.0
3/4	96.0	160.0	224.0	236.8
7/8	152.0	241.6	352.0	378.4
.0	225.6	372.8	528.0	571.2

Bolt Torques for Bus Connections

Silicon Bronze Fasteners*

Torque (Foot Pounds)

Diameter	Non-Lubricated	Lubricated
5/16	15	10
3/8	20	14
1/2	40	25
5/8	55	40
3/4	70	60

*Bronze alloy bolts shall have a minimum tensile strength of 70,000 pounds per square inch.

Aluminum Alloy Fasteners**

Torque (Foot Pounds)

Diameter	Lubricated
5/16	8.0
3/8	11.2
1/2	20.0
5/8	32.0
3/4	48.0

**Aluminum alloy bolts shall have a minimum tensile strength of 55,000 pounds per square inch.

Bolts, Capscrews, Flat Washers: 2024-T4 alloy

Nuts: 6061-T6 alloy

Lock Washers: 7075-T6 alloy

Bolt Torques for Bus Connections

Stainless Steel Fasteners***

Torque (Foot Pounds)

Diameter	Uncoated
5/16	14
3/8	25
1/2	45
5/8	60
3/4	90

Bolts, Cap Screws, Nuts, Flat Washers, Locknuts: 18-8 alloy

Belleville Washers: 302 alloy

TABLE 3.3

Insulation Resistance
Conversion Factors

For Conversion of Test
Temperature to 20°C

Temperature		Temperature	
°C	°F	Oil	Dry
0	32	.25	.40
5	41	.36	.45
10	50	.50	.50
15	59	.75	.75
20	68	1.00	1.00
25	77	1.40	1.30
30	86	1.98	1.60
35	95	2.80	2.05
40	104	3.95	2.50
45	113	5.60	3.25
50	122	7.85	4.00
55	131	11.20	5.20
60	140	15.85	6.40
65	149	22.40	8.70
70	158	31.75	10.00
75	167	44.70	13.00
80	176	63.50	16.00

END OF SECTION 266001

SECTION 270527 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Telephone/Data Service: Provide conduits, RJ45 jacks, Cat. 6 wiring, outlets, back boxes, pull boxes, plywood backboards and junction boxes.

B. Provide telephone, data and combination outlets where indicated including wall box, extension ring box cover and blank coverplate.

C. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Boxes and enclosures.

D. Related Requirements:

1. Division 26 Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
2. Division 26 Section 260500 “Common Work Results for Electrical”.

1.2 ACTION SUBMITTALS

A. Product Data: For surface pathways and fittings.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

2. Fittings for EMT:

   a. Material: Steel.
   b. Type: Setscrew.

F. Joint Compound for GRC or ARC: 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.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Continuous HDPE: Comply with UL 651B.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 BOXES AND ENCLOSURES

A. General Requirements for Boxes and Enclosures:

1. Comply with TIA-569-B.
2. Boxes and enclosures installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

E. 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: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic or fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

F. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

J. Gangable boxes are prohibited.

K. Wall outlets shall have suitable 4-11/16 inch x 4-11/16 inch boxes equipped with standard two gang split stainless steel telephone plates with 1/2 inch bushed hole in center.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in damp or wet locations.
3. Exposed and Subject to Severe Physical Damage: GRC.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: GRC.
6. Pathways for Concealed General-Purpose Distribution of Communications Cable: General-use, communications-cable pathway.

B. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

C. Minimum Pathway Size: 3/4-inch (21-mm) trade size.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew, fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings.

F. Install surface pathways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Comply with requirements in Division 26 Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install wall outlet boxes and floor activations as indicated.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

H. The Contractor shall record all deviations from the approved drawings and specifications as they occur to clearly depict the actual installation. Particular attention shall be given to concealed work. There “as-built” field records shall include descriptions, drawings, sketches, marked prints and similar data.

I. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

K. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

M. Spare Pathways: Install pull wires in empty pathways. Cap underground pathways designated as spare above grade alongside pathways in use.

N. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.

O. Pathways for Communications Cable: Install pathways as follows:

1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements.

P. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound.

Q. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) 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.

S. Mount boxes at heights indicated on Drawings in accordance with ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

U. These field records shall be maintained at the job site and shall be kept current on a daily basis as the work progresses. At the conclusion of the installation work, the Contractor shall provide the Owner’s Representative one (1) complete set of updated, clearly marked, redline drawings and specifications.

V. No other wires shall be installed in telephone/data conduit. Owner’s telephone company will provide telephones.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 27 Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Section 078413 "Penetration Firestopping."

END OF SECTION 270527

SECTION 270528 - VOICE AND DATA COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of Section 260500, Common Work Results for Electrical, bound herein, form a part of this Contractor's Work and shall be considered a part of this Section.

1.2 WORK DESCRIPTION

A. Telephone/Data Service: The contractor shall provide interior branch conduit, wiring, jacks, J-hooks, surge protected terminal blocks, distribution terminal blocks, wiring, plywood backboards, outlets, back boxes, pull boxes, junction boxes, and cover plates.

B. The contractor shall provide telephone, data, and combination outlets where indicated including wall box, extension ring box cover, telephone/data wiring to outlets, jacks, J-hooks and blank cover plate with EMT stubbed into ceiling spaces. Size as indicated on drawings.

C. Owner will provide telephones, switches, servers, firewall, voice patch panels, data patch panels, data rack, final terminations, and mainframe computer equipment, router, etc.

1.3 SUBMITTALS

A. Submit product data for the following materials:
   1. Telephone protected terminals.
   2. Telephone distribution terminal blocks.

PART 2 - MATERIALS

2.1 TELEPHONE/DATA DISTRIBUTION SYSTEMS

A. Wall outlets shall have suitable 4-11/16 inch x 4-11/16 inch boxes equipped with standard two gang split stainless steel telephone plates with 1/2-inch bushed hole in center.

2.2 VOICE AND DATA CABLES

A. Refer to Section 270529 “Telecommunications General”.

B. Refer to Section 271300 “Control/Signal Transmission Media”.

2.3 TELEPHONE DISTRIBUTION SYSTEMS

A. Provide RJ45 jacks to match Owner’s type.

B. Install ground terminal at service location and connect to building grounding electrode system.

C. Provide Type 66 or 110 terminal blocks mounted on stand-off brackets.

D. Mount terminals on a backboard located in Closet #106.

E. Phone/data outlets with one (1) phone and (1) data Cat-6 cables at each jack location unless otherwise noted to provide (4).

F. Provide Cat-6 phone/data wiring as required to be compatible with Owner's system.

G. Backboards shall be 3/4-inch interior grade plywood, W/Class A fire rating. Plywood and area of wall used for mounting shall be painted with black waterproof paint. From this area, run conduit into junction boxes and telephone locations where indicated. Provide two (2) 4' long power strips with outlets 6" on center.
   1. A #6 ground wire will be required from each backboard preferably to a ground buss or to the power service ground rod. If it is not possible, a ¾" thinwall conduit must be provided along with the #6 ground wire to the ground source.

H. Provide J-hooks or bridle rings to support cables above ceilings.

I. Contractor shall terminate cables if they need to in order to warranty their work and certify that it is capable up to one gigabyte.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall outlet boxes and floor activations as indicated.

B. The Contractor shall record all deviations from the approved drawings and specifications as they occur to clearly depict the actual installation. Particular attention shall be given to concealed work. These "as built" field records shall include descriptions, drawings, sketches, marked prints and similar data.

C. These field records shall be maintained at the job site and shall be kept current on a daily basis as the work progresses. At the conclusion of the installation work, the Contractor shall provide the Owner's Representative one (1) complete set of updated, clearly marked, redline drawings and specifications.

D. No other wires shall be installed in telephone/data conduit. Owner's telephone company will provide telephones.

E. Contractor shall be responsible to coordinate installation of telephone/data equipment with the Owner's telephone/data company supplier.

F. All conduits shall be terminated with bushings. In general, not more than two 90 degree bends shall be inserted in a conduit run. No other system wiring shall be inserted in any telephone conduits. Minimum size conduit shall be 3/4 inch.

G. All communications conduits shall be uniquely identified with the room number and an additional identifier if there is more than one communication outlet in a room. All communication outlets shall be identified on record drawings with the unique communication outlet identifier.

H. No splicing allowed.

I. Mount terminals on a backboard.

J. Provide modules and patch panels with 4’ swing rack to handle all drops.

K. Install wall outlet boxes as indicated.

L. The contractor shall record all deviations from the approved drawings and specifications as they occur to clearly depict the actual installation. Particular attention shall be given to concealed work. These “as-built” field records shall include descriptions, drawings, sketches, marked prints and similar data.

M. These field records shall be maintained at the job site and shall be kept current on a daily basis as the work progresses. At the conclusion of the installation work, the contractor shall provide the Owner’s representative one (1) complete set of updated, clearly marked, redline drawings and specifications.

END OF SECTION 270528

SECTION 270529 – TELECOMMUNICATIONS GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, and Supplementary Conditions and Division 1 Specifications, apply to this document.

1.2 SUMMARY

A. A sound, structured cabling system is imperative to support voice, data and video services. Therefore, it is the intent of this document to provide specific technical specifications resulting in a standard level of quality. This standardization will involve the review and adoption of existing and emerging industry standards resulting in an efficient telecommunications infrastructure.

B. Provide all equipment, materials, labor, and services, not specifically mentioned or shown, which may be necessary to complete or perfect all parts of the installation. Ensure that they are in compliance with requirements stated or reasonably inferred by the contract documents.

1.3 DEFINITIONS

A. ANSI: American National Standards Institute

B. BICSI: Building Industry Consulting Service International

C. EIA: Electronic Industries Alliance

D. NEC: National Electrical Code

E. RCDD: Registered Communications Distribution Designer

F. TIA: Telecommunications Industry Association

G. HC: Horizontal Cross-Connect (Floor Distributor)

H. IC: Intermediate Cross-Connect (Building Distributor)

I. MC: Main Cross-Connect

J. Engineer/Designer: The term Engineer/Designer as used in these specifications refers to the Consultant/Engineer.

K. Owners Representative: The term Owners Representative as used in these specifications refers to Physical Plant and/or Information Technology Departments.

L. Contractor: The term Contractor as used in these specifications refers to the organization that shall furnish all the labor, materials, equipment, services, and supervision to perform all the work shown on the drawings and specifications.

1.4 REFERENCES

A. The following industry standards are the basis for the structured cabling system described in this document.

B. ANSI/TIA/EIA

1. ANSI/TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard, Part 1: General Reqts.
2. ANSI/TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components
3. ANSI/TIA/EIA-568-B.3 Optical Fiber Cabling Components Standard
4. ANS/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces
5. ANSI/TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
6. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications
7. ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss of Installed Single Mode Fiber Cable Plant
8. ANSI/TIA/EIA-526-14A Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant
9. ANSI/TIA/EIA-758(A) Customer Owned Outside Plant Telecommunications Cabling Standard

C. BICSI

1. BICSI – Telecommunications Distribution Methods Manual
2. BICSI – Cabling Installation Manual
3. BICSI – LAN Design Manual
4. BICSI – Customer-Owned Outside Plant Design Manual

D. NFPA

1. NFPA-70 - National Electric Code (NEC)

E. IEEE

1. C2-2002 - National Electric Safety Code (NESC)

F. ISO/IEC

1. ISO/IEC 11801 - General Cabling for Customer Premises

The most recent versions of the above documents apply to this project.

Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owners Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

1.5 SUBMITTALS

A. Submit to the engineer/designer shop drawings, product data (including cut sheets and catalog information) required by the contract documents. Submit shop drawings and product data with such promptness and in such sequence as to cause no delay in the work or in the activities of separate contractors. The engineer/designer will indicate approval of shop drawings, product data, and samples submitted to the engineer/designer. Submitted shop drawings shall be initialed or signed by the contractor, showing the date and the contractor's legitimate firm name.

1. By submitting shop drawings and product data, the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the contractor has checked, coordinated, and verified that information contained within shop drawings and product data conform to the requirements of the work and the contract documents. The engineer/designer remains responsible for the design concept expressed in the contract documents as defined herein.
2. The engineer's/designer's approval of shop drawings and product data submitted by the contractor shall not relieve the contractor of responsibility for deviations from requirements of the contract documents, unless the contractor has specifically informed the engineer/designer in writing of such deviation at time of submittal, and the engineer/designer has given written approval of the specific deviation. The contractor shall continue to be responsible for deviations from requirements of the contract documents not specifically noted by the contractor in writing, and specifically approved by the engineer/designer in writing.
3. The engineer's/designer's approval of shop drawings and product data shall not relieve the contractor of responsibility for errors or omissions in such shop drawings and product data.
4. The engineer's/designer's review and approval, or other appropriate action upon shop drawings and product data, is for the limited purpose of checking for conformance with information given and design concept expressed in the contract documents. The engineer's/designer's review of such submittals is not conducted for the purpose of determining accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the contractor as required by the contract documents. The review shall not constitute approval of safety precautions or of construction means, methods, techniques, sequences, or procedures. The engineer's/designer's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

B. Perform no portion of the work requiring submittal and review of shop drawings and product data, until the engineer/designer has approved the respective submittal. Such work shall be in accordance with approved submittals.

C. Submit shop drawings, product data, and samples as a complete set within fifteen (15) days of award of contract, unless otherwise specified in the contract documents.

1. For initial submission and for resubmission required for approval, submit six (6) copies of each item. The engineer/designer will only return four copies. Make reproductions as required for your use and distribution to contractors.
2. Illegible submittals will not be checked by the engineer/designer.

D. General: Submit the following:

1. Bill of materials, noting long lead time items.
2. Project schedule including all major work components that materially affect any other work on the project.

E. Shop drawings: Submit the following:

1. System block diagram, indicating interconnection between system components and subsystems.
2. Interface requirements, including connector types and pin-outs, to external systems and systems or components not supplied by the contractor.
3. Fabrication drawings for custom-built equipment.

F. Product Data – Provide catalog cut sheets and information for the following:

1. Wire and cable.
2. Outlets, jacks, faceplates, and connectors.
3. Terminal blocks and patch panels.
4. Data racks.

G. As-Built drawings:

1. Submit as-built drawings upon acceptance of the project and include:

a. Approved shop drawings.
b. Plan drawings indicating locations and identification of work area outlets, nodes, telecommunications rooms (TRs), and backbone (riser) cable runs.
c. Telecommunication rooms (TRs) and equipment room (ER and/or MC) termination detail sheets.
d. Cross-connect schedules including entrance point, main cross-connects (MC), intermediate cross-connects (IC), and horizontal cross-connects (HC).
e. Labeling and administration documentation.
f. Warranty documents for equipment.
g. Copper certification test result printouts and diskettes.

H. Operation and maintenance manuals:

1. Provide three (3) copies of operations and maintenance manuals. As a minimum, manuals should include:

a. Complete schematics of each system component.
b. Troubleshooting procedures.
c. Factory-authorized support information.

1.6 QUALITY ASSURANCE

A. Contractor Qualifications: Cabling installer must have on staff personnel certified by Building Industry Consulting Service International (BICSI) and/or manufacturer certified installer as noted.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of a Registered Technician or Level 2 Installer, who shall be present at all times when work of this Section is performed at job site.
3. The contractor shall have worked satisfactorily for a minimum of three (3) years on systems of this type and size.
4. The contractor must provide at least three (3) references with specific information regarding type of project and involvement in providing of equipment and services.
5. Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the Owner, Owners Representative and Engineer/Designer.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by BICSI as an RCDD to supervise field quality control testing.

C. Source limitations: Obtain all products except cables through one source from a single manufacturer.

D. 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.

E. Comply with NFPA 70, "National Electrical Code."

F. Comply with IEEE C2-2002 "National Electrical Safety Code."

1.7 WARRANTY

A. Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than three (3) years from date of acceptance by the Owner. The Owners Representative shall deem acceptance as beneficial use.

B. Transfer manufacturer's warranties to the Owner in addition to the General System Guarantee. Submit these warranties on each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve the contractor of these obligations.

C. No warranty or terms therein shall limit or be interpreted to limit remedies as provided by law.

1.8 COORDINATION

A. Coordinate layout and installation of voice and data communication cabling with the Owners telecommunications and LAN equipment and service suppliers.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owners Representative and Engineer/Designer to exchange information and agree on details of equipment arrangements and installation interfaces as requested by the Owner.
2. Prepare meeting minutes noting agreements, decisions, topics discussed, etc. and distribute in a timely manner.
3. Adjust arrangements and locations of distribution frames, cross-connect, patch panels, etc. in equipment rooms and wiring closets to accommodate space requirements of telephone switch and LAN equipment.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment during transit, storage, and handling to prevent damage, theft, soiling and misalignment. Coordinate with the Owners Representative for secure storage of equipment and materials. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment. Notify the Owners Representative immediately of any such event in writing.

1.10 USE OF THE SITE

A. Use of the site shall be at the Owners Representative direction in matters in which the Owner deems it necessary to place restriction.

B. Access to the building wherein the work is performed shall be as directed by the Owners Representative.

C. The premises may be occupied during the entire period of construction for conducting normal business operations. Cooperate with the Owners Representative to minimize conflict and to facilitate its operations.

D. Schedule necessary shutdowns of plant services with the Owners Representative, and obtain written permission. Refer to CONTINUITY OF SERVICES herein.

E. Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits and operations of Owner.

1.11 CONTINUITY OF SERVICES

A. Take no action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Owners Representative. Arrange the work to minimize shut down time.

B. The Owners personnel will perform shutdown of operating systems. The contractor shall give three (3) days' advance notice for systems shutdown.

C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Product selection subject to compliance with the Owners standard requirements, provide products by one of the manufacturers specified.

2.2 FABRICATION

A. Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of equipment and its installation.

2.3 SUITABILITY

A. Provide products that are suitable for intended use, including, but not limited to environmental, regulatory, and electrical.

PART 3 - EXECUTION

3.1 INSTALLATION STANDARDS

A. Comply with BICSI TDM, ANSI/TIA/EIA-568-B.1, ANSI/TIA/EIA-568-B.2, ANSI/TIA/EIA-568-B.3, ANSI/EIA/TIA-569-A, ANSI/EIA/TIA-606, and ANSI/EIA/TIA-607.

3.2 PRE-INSTALLATION SITE SURVEY

A. Prior to start of systems installation, meet at the project site with the Owners Representative and representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work.

B. Examine areas and conditions under which the system is to be installed. Do not proceed with the work until satisfactory conditions have been achieved.

C. Examine pathway elements intended for cables.

1. Verify proposed routes of pathways. Check raceways and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with Electro Magnetic Interference (EMI) clearance requirements.
2. Identify plan to support cables and raceways in suspended ceilings. Verify weight of individual types and sizes of cables. Verify that load capacity of cable support structures is adequate for each pathway.

3.3 PATHWAY COORDINATION

A. Provide construction interference sketches showing detail of cable, tray & raceway supports, required deviations at interference points with utilities, equipment, etc.

B. Prepare wall penetrations and verify that penetrations of rated fire walls are restored using products labeled for type of wall penetrated.

C. Proceed with installation only after identified satisfactory solutions have been selected for unsatisfactory conditions.

3.4 HANDLING AND PROTECTION OF EQUIPMENT AND MATERIALS

A. Be responsible for safekeeping of your own and your subcontractor's property, such as equipment and materials, on the job site. The Owner assumes no responsibility for protection of above named property against fire, theft, and environmental conditions.

3.5 PROTECTION OF OWNER'S FACILITIES

A. Effectively protect the Owners facilities, equipment, and materials from dust, dirt, and damage during construction.

B. Remove protection at completion of work.

3.6 INSTALLATION - GENERAL

A. Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by the Owners Representative. Include delivery, unloading, settling in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.

B. Install materials and equipment in accordance with applicable standards, codes, requirements, and recommendations of national, state, and local authorities having jurisdiction, and National Electrical Code (NEC) and with manufacturer's printed instructions.

C. Consideration shall be given for operational efficiency and aesthetic factors in the installation of equipment and cables.

D. Deviations from current standards are not acceptable without express written approval of the Owners Representative.

E. Due to field conditions or other situations, installation locations may have to be relocated a reasonable distance from the plan location. Unless relocations, modifications and reengineering are consistently or substantially unfavorable to either the contractor or the Owners Representative, there will be no additional charge or credit for this work.

F. The cabling contractor shall accomplish all cutting, removal and replacement of ceiling tile, drilling, coring and patching of walls, floors and ceilings required to complete this work.

G. Secure and support cables with suitable attachments (e.g. J-Hook cable hangers) at intervals not exceeding 60 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

H. Care must be taken to ensure cables are not kinked, bent beyond limit, overloaded, over-cinched, crushed, improperly untwisted, etc. Contractor may not hang any cable from existing lighting or ceiling supports.

I. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall be not be used for heating.

J. No "stick-on" cable wraps, raceways or terminal devices are acceptable. All conduit, cable and raceway installation support must be mechanically fastened to walls, decks, slab, structure, etc. In general, adhesives and non-mechanical fastening methods of installation will not be acceptable.

3.7 FIELD QUALITY CONTROL

A. Every job superintendent or project manager during the course of the installation to provide coordination of work of this specification and of other trades, and provide technical information when requested by other trades. This person shall maintain current RCDD (Registered Communications Distribution Designer) registration and shall be responsible for quality control during installation, equipment set-up, and testing.

B. At least one on site personnel shall be BICSI Registered Telecommunications Installer. Installer performing connections, terminations, testing, etc. shall be registered at the Installer Level 2.

C. Installation personnel shall meet manufacturer's training and education requirements for implementation of extended warranty program.

END OF SECTION 270529

SECTION 271300 – CONTROL/SIGNAL TRANSMISSION MEDIA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of control and signal transmission media.

1. Twisted-pair cable, CAT 6.

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

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for building wire used for control or signal circuits.
2. Section 260553 “Identification for Electrical Systems”.
3. Section 270528 "Voice and Data Communications System."

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

1. Product data for control/signal transmission media.
2. Field reports indicating and interpreting test results.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" current edition for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The terms "Listed and Labeled": As defined in the "National Electrical Code", Article 100.

C. Single-Source Responsibility: All cable of each kind shall be the product of a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:

1. Electrical Cable.

a. American Insulated Wire Corp.
b. Cable and Wire Division, AT&T Technology, Inc.
c. Berk-Tek, Inc.

d. Brand-Rex Cable Systems, Cablec Corp.
e. Belden Division, Cooper Industries.
f. General Cable, Guardian Products

2.2 MISCELLANEOUS ELECTRONIC CABLE

A. A single conductor coaxial: 50-ohm characteristic impedance, cellular polyethylene core; 97 percent coverage, bare copper-braid shield, polyvinyl chloride (PVC) jacket; conforming to MIL-C-17, Type RG-58/U.

B. Single Conductor Coaxial: 75-ohm characteristic impedance, solid polyethylene core; 97 percent coverage, copper-braid shield, polyethylene jacket; conforming to MIL-C-17, Type RG-6A/U&.

C. Multi-conductor Cable: Quantity of twisted pairs indicated; 18 AWG tinned-cooper conductors; color-coded, low-loss polyethylene chloride (PVC) insulation; aluminum/Mylar shield and 22 AWG tinned-copper drain wire; (PVC) jacket.

D. Unshielded Twisted Pair: Quantity of twisted pairs indicated; 22 AWG tinned-cooper conductors; color-coded, low-loss polyethylene insulation; unshielded, polyvinyl chloride (PVC) jacket.

E. Shielded Twisted Pair: Quantity of twisted pairs indicated; 22 AWG tinned-cooper conductors; color-coded, polyvinyl chloride (PVC) insulation; overall aluminum/polyester shield and 22 AWG tinned-copper drain wire; Teflon jacket; suitable for use in air-handling spaces.

F. Shielded Twisted-Pair Plenum: Quantity of twisted pairs indicated; 24 AWG, 7-strand, tinned-copper conductors; Teflon insulation; overall aluminum/polyester shield and 22 AWG tinned-copper drain wire; Teflon jacket suitable for use in air-handling spaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and other elements to receive cable for compliance with installation tolerances and other adverse conditions. Do no proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cable as indicated, according to manufacturer's written instructions.

1. Install transmission media without damaging conductors, shield, or jacket.
2. Do not bend cable, in handling or installation, to smaller radii than minimum recommended by manufacturer.

B. Pull cables simultaneously where more than one is being installed in same raceway.

1. Pull cables simultaneously where more than one is being installed in same raceway.
2. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

C. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

D. Use splice and tap connectors that are compatible with cable material.

1. Make no splice except at indicated splice points.

E. Bond shields and drain conductors to ground at only one point in each circuit.

F. Connect components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.3 TESTS AND INSPECTIONS

A. The Contractor shall, at all times, permit and facilitate work inspection by the Owner's Representative and by public authorities having jurisdiction. The Owner's Representative shall have the authority to stop the work; if required, to ensure proper execution.

B. All cable tests shall be performed in accordance with industry standard testing procedures. The Contractor must provide a Data Cable Schedule form to document the twisted pair cable test results. The Contractor also shall submit two (2) copies of all testing procedures to the Owner's Representative no later than three (3) working days beyond cable completion date.

C. Copper Cable Procedures: Inspect for physical damage and test cable for continuity and shorts. Use time domain reflectometer with strip chart recording capability and anomaly resolution to within 12 inches (300 mm) in runs up to 1000 feet (300 m) in length. Test cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.

D. Correct malfunctioning units at site, where possible, and re-test to demonstrate compliance; otherwise, remove and replace with new units and re-test.

E. A final walk-through will be held and test results reviewed by the Owner to determine compliance with the drawings, specifications, and codes prior to final acceptance and payment.

3.4 CLEANING

A. Upon completion of system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

3.5 DEMONSTRATION

A. Operate control/signal systems to demonstrate proper functioning. Replace malfunctioning cable with new materials, and then re-test and recommission until satisfactory performance is achieved.

B. Train Owner's maintenance personnel on procedures and schedules for start-up and shut-down, troubleshooting, servicing, and preventive maintenance.

C. Review data in operating and maintenance manuals. Refer to Division 1 Section "Operating and Maintenance Data."

D. Schedule training with Owner, through Architect, with at least 7 days' advanced notice.

END OF SECTION 271300

SECTION 275117 – AUDIO VISUAL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wireless remote control.
2. Power amplifiers.
3. Hand held wireless microphones.
4. A/V control system controllers.
5. Loudspeakers.
6. Microphone outlets.
7. Conductors and cables.
8. Raceways.
9. Equipment rack.
10. DVD players.
11. LED televisions.
12. Video presenters.
13. Video floor boxes.
14. Video switchers.
15. Audio mixer/processor.
16. Lapel wireless microphones.
17. Audio/video recording.

1.2 RELATED DOCUMENTS AND GENERAL SCOPE

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications section apply to work of this section. The work of this section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all audiovisual equipment and related work for this project as required by the schedules and drawings and specifications.

B. The system design for the building consists of a main audio visual system for the meeting room.

1.3 GENERAL

A. The Owner is seeking proposal for the design and installation of a new audio visual specialty system for the meeting room. Bidders responding to this proposal must include with the bid document three (3) copies of the complete proposal. Generally speaking, the minimum documentation requirements are described in Section 1.4 of the section.

B. In addition to the required documentation, each bidder is encouraged to provide any additional documentation that will assist the engineer in evaluating their proposal. Bidders should include information on an annual service contract for each system, list of similar audio visual installations, including name, address, contact name and phone number.

C. Furnish all labor, materials and equipment required, and furnish and install all audio reinforcement equipment systems complete with all accessories and incidental work required, in accordance with the drawings and these specifications.

1. Determine and provide quantities of installed equipment based on the Bid Documents including the functional diagrams, plans, riser diagrams, and specification.
2. The system drawings indicate the general layout of the various items of equipment and their functional relationships. Layout of equipment, accessories, and conduit systems are diagrammatic unless specifically detailed and do not indicate every item or parameter required for a complete installation.

D. Provide all labor and materials required for the complete installation of the new audio visual presentation system as hereinafter specified and as shown on the drawings. The materials listed are to be considered the base bid. The base bid is for the materials and services specified.

E. All parts and materials shall be new and where applicable, shall bear manufacturer's model and serial numbers, and U.L. labels. Protect all equipment from construction dust and debris until final acceptance.

F. Individual parts and complete assemblies shall be in all particulars as specified and as manufactured by Biamp, I.COMM, Teamboard, Elmo, Panasonic, Sennheiser, Crown, JBL, Mitsubishi, Da-Lite, Samsung, Crestron, Middle Atlantic, Polycom, etc. or equal and as provided and installed by I.COMM of Wixom, Michigan 1-800-284-2391. The provision of all manufactured components, installation, wiring, and testing is the responsibility of a single audiovisual system contractor.

G. The Contractor shall be an authorized distributor of the specified equipment and shall supply manufacturer's verification attesting to this fact.

H. All equipment and workmanship shall be guaranteed for one (1) year from the date of acceptance against defects.

I. The Contractor must maintain a sufficient service organization and be able to respond to a call for service within 24 hours.

J. The Contractor (or his representative) shall be available on four (4) hours notice, and without cost to the Owner, during the fist month of full scale operation, following acceptance of the system, to assist the Owner and/or his representatives in any problems that may arise during the initial period of operation or to help the Owner set up for specific functions.

K. The Contractor shall do all cutting, patching and painting necessary for proper and finished installation of the system and repair any damage done as a result of such installation. Clean-up and dispose of trash from all system work areas.

L. The Contractor shall provide any additional incidental items, not specifically mentioned herein, necessary to meet system requirements as specified, without claim, for additional payment, in order to result in a complete and operable system even if not specified or shown on the drawing without claim for additional payment.

M. The Contractor shall perform initial adjustments and verification tests. Submit verification test reports to the architect before final is made.

N. The Contractor shall participate in acceptance tests and perform final adjustments as required.

O. Contractor shall furnish and install the back boxes, wire and other items of "rough-in" equipment and shall properly tag the audio and video cables at termination points.

P. The Contractor shall furnish and install to the audio equipment and shall test, equalize and place the system into operation.

Q. Refer to audiovisual conduit drawings for receptacle back box location and quantity information. Also refer to architectural reflected ceiling plans for the location of any ceiling mounted devices.

R. It shall be the responsibility of the A/V integration contractor to install any miscellaneous steel, such as Unistrut and safety cables above the ceiling for mounting each plasma television, boxes, screen, or display device.

S. Conduits, sleeves, and standard back boxes are to be supplied by the electrical contractor and are not to be provided by the audio visual contractor. Fire stopping all sleeves containing A/V cables will be the responsibility of the A/V contractor. The A/V contractor will be responsible for supplying any miscellaneous wireway, flex, or conduit required to professionally enclose cables leaving equipment racks to the wall or to the ceiling space.

T. Flush Floor boxes: All floor boxes will be supplied and installed by the electrical contractor.

U. The materials listed are to be considered the base bid. Voluntary alternates are encouraged but all substitutions will be treated as a voluntary alternate only and as a separate add or deduct. Any substitutions shall be clearly indicated on the Voluntary alternate form and supported with specification sheets and a detailed description of how the alternate benefits the owner. **The base bid is for the materials and services specified.** Products and installation by I.Comm, 248-960-3700.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. The Contractor shall submit for approval three (3) copies of brochures containing typewritten, accurate material lists, supporting catalog and engineering data on all system components, dimensions of all equipment, functional block diagrams, equipment rack layouts for each system prior to assembly or installation and projector and display mounting details at the time of the bid. All questions are to be directed in writing only to Dan Lutes of DiClemente Siegel Design, Inc., 1-810-238-1024.

C. At the conclusion of the project, the Contractor shall submit three (3) prints of “as-built” functional block diagrams, rack layouts, operation manuals for all control equipment. Additionally, each equipment cabinet shall contain an “as wired” functional block diagram showing all components and their connection by number. All internal cabinet wiring shall be tagged in accordance with the functional diagram. Final payment shall not be made until the “as-builts” have been received and signed for by the owner.

D. Submit for approval, prior to system fabrication or installation, the following:

1. A complete and accurate list of materials (Bill of Materials).
2. Catalog and engineering data on individual system components.
3. Dimension of all equipment and racks.
4. A functional block diagram indicating component interconnections.
5. Rack layouts for each system.
6. All custom assemblies and samples of lettering/label size and type face.
7. Proposed mounting arrangements and details of all loudspeakers, including positioning devices, framework supports and interfaces with adjacent architecture.
8. Shop drawings shall be provided showing the addition of any components, such as transformers, line/distribution amplifiers, switches, power supply or other devices, not detailed in this specification, but necessary to provide a properly functioning and complete system.

9. Organize the Bill of Materials with the information presented in the order and format that it appears in this specification.
10. After the Bill of Materials, include Data Catalog sheets for all specified products arranged in the order of the Bill of Materials.
11. Failure to submit the necessary drawings, Bill of Materials, or specifications sheets as indicated above will deem the response in non-compliance and will be rejected.
12. Provide an assembled three-ring binder. All pages shall be numbered which shall be included in the Table of Contents. The Table of Contents shall be as follows:

    a. Tab 1: Cover letter to include executive overview of the project depicting the A/V integration contractor's understanding of the project.
    b. Tab 2: Bid proposal form to include an itemized Bill of Materials in the order they appear in the specifications.
    c. Tab 3: Voluntary/Mandatory alternates including itemized prices and description of the alternate and the advantages to the Owner.
    d. Tab 4: Specification sheets (by room) for the A/V communications system.
    e. Tab 5: Reference listing of similar projects successfully completed with contact names, addresses, and phone numbers.
    f. Tab 6: Company profiles for prime contractors and sub contractors and/or outside of company programming resources.
    g. Tab 7: Maintenance and service contract for years two and three (after warranty expiration). This exhibit should include response times, what factors determine an "emergency," service rates, and an explanation of hours of service times (normal hours, after hours, etc.).

13. The Contractor must maintain a sufficient service organization and be able to respond to a call for service within 24 hours and a catastrophic failure within 4 hours.
14. The Contractor shall provide eight-hours of training to teach the staff the use of the system. The successful contractor shall employ training sheet documentation that indicates the name of the person and duration of the session. This training sheet shall be part of the "as-built" documentation.
15. The Contractor shall do all cutting, patching, and painting necessary for proper and finished installation of the system and repair any damage done as a result of such installation. Clean up and dispose of trash from all system work areas.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

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 NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

1. Biamp.
2. Teamboard.
3. Panasonic.
4. Polycom.
5. Elmo.
6. Crestron.
7. Sennheiser.
8. Crown.
9. JBL.
10. Middle Atlantic.
11. West Penn.
12. I.COMM.
13. Mitsubishi
14. Da-Lite.
15. Samsung.

2.2 SCOPE OF THE PROJECT

A. This installation includes all peripheral devices such as structural hardware, mounts, power supplies, and any “field related” components necessary to allow the system to function. Provide all materials and labor required for a complete installation of the audio visual presentation system, as herein specified and as shown on the drawings. As part of this project the contractor shall supply ancillary equipment not specifically mentioned, which may be necessary to complete a total system at no additional cost to the Owner.

B. The Owner is looking for a “turnkey solution” that will provide all of the functions as described below under Functional Description.

C. The audio visual system contractor shall provide all necessary installation, set up, testing and training of staff as required to ensure proper operation of the system.

2.3 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Audio visual presentation system.

B. Scope - Video: The audio visual presentation system proposed for the meeting room shall provide for the automatic processing of the following resources and appliances:

1. The system controller shall turn on the LED televisions in conjunction with any of the video playback, document display or computer display functions in the “combined mode.”
2. The Blue Ray player output shall be routed automatically to the displays in the room as HDM1 video outputs. Acceptable products shall be:

a. Samsung Blue Ray player model BDF6700 HDM1 and Ethernet output.
b. Sony Blue Ray player model BDPSB790 with HDM1 and Ethernet output.

3. The system shall employ two (2) Sharp model LC70LE650 LCD displays as shown on the drawings. The devices shall have full HD 1080p resolution with four (4) HDMI inputs, one (1) PC input and one (1) USB input.
4. The central control and signal switching unit shall process the following inputs and signals:
    - Computer in rack (Owner supplied)
    - Computer input #2 (on wall plate)
    - Blue Ray player

    a. The system controller with video switching and audio control shall be a fully integrated, programmable system for control of the audio visual equipment and other motorized, electronic, or electrical devices that need to be controlled.
    b. The system shall provide on-board switching of multiple video and audio sources to two composite video outputs or one S-video output, and one balanced or unbalanced stereo output in one module; switching of three S-Video and four RGB sources to two outputs, respectively in the second module.
    c. Supports 4-wire control network operation for interfacing with outboard, remote devices including control modules and control panels and slave mode operation under a primary control system processor.
    d. Supports 3-wire IR receiver port control for interfacing with multi-button wireless RC-5 protocol and IR remote controls.
    e. Supports 8-wire LAN/Ethernet expansion of the control network, including onboard web server with static-dynamic IP addressing with SSL (Secure Socket Layer) and POP3 email server with automated send/receive service.
    f. Four IR/serial ports, two RS-232/422/485 ports, four relays, and four I/O ports.
    g. Programmable with high level language via an external IBM-compatible or MAC computer (actual computer is not part of this bid package).
    h. Provide one (1) controller for system.
        1) Hand held control panel model Crestron #TPS-6000.
    i. The touch panel shall be capable of controlling central A/V sources as listed but not limited to:
        1) The Blue Ray Player functions that shall be remotely controlled are:
            a) Play
            b) Pause
            c) Step Reverse
            d) Stop
            e) Fast Forward
            f) Step Forward
            g) Eject
            h) Reverse
            i) Display
            j) Chapter Search Forward
            k) Chapter Search Reverse
            l) Menu
            m) Directional Keys for Menu Navigation

    j. The presentation system processor shall provide a touch panel interface, seamless video switcher, and embedded multi-media PC equipped with a number of presentation features with built-in support for displaying traditional A/V formats.
    k. The presentation system processor shall provide complete display control to the presenter, providing independently controlled outputs to the presenter's touch panel and audience display. Multiple scalable video windows and PC applications can be displayed simultaneously.
    l. Provide video recording for system.

C. Scope – Audio: The audio system provides for the amplification and distribution of audio from the mixer amplifier Blue Ray player, wall plate audio visual inputs.

1. The system shall employ a diversity wireless microphone and receivers for the presenters. A hand held and lavaliere microphone shall be provided. Provide and install two (2) AKG WMS-470 presenter systems with two (2) hand held mic Transmitters and two (2) lavaliere mic/transmitters. Provide all rack hardware to mount in control rack.
2. The mixer amplifier shall be a Biamp audio system with (12) 1P-2 input cards and equalizer/processors and two (2) OP-2 output cards, and equalizer/processor. Provide mixing and processing as necessary per the plans and specifications.
3. The power amplifiers shall be Crown CDI 1000 series power amplifiers. Each amplifier shall be capable of the following performance criteria: 185 watts into a 70 volt line; frequency response of 20-20 KHz, T.H.D. of less than 0.05%.
4. The ceiling mounted speakers shall be JBL series 26 CT series coaxial speakers capable of the following performance criteria: Frequency response 65 – 20 KHz, sensitivity of 86 dB at 1 watt/1m, maximum SPL of 110 dB, and provided with an integral 70.7 volt 30 watt transformer.
5. The central control rack shall be Middle Atlantic ERK 4425AV 77" equipment rack with solid front door. Provide the required number of blank panels to give the equipment rack a professional finished look (no empty spaces). Provide one (1) model #LBX-4 lockable storage lockbox and one (1) model SS heavy duty sliding shelf for the Owner supplied computer.

    a. Microphone cable shall be West Penn model 25292, 20 awg. shielded pair cable with an overall foil and drain wire.
    b. Speaker cable shall be West Penn 25224, 18 awg. pair with an overall vinyl jacket.
    c. Video cable shall be West Penn 25841 RG6 type 18 awg. solid coaxial cable with 100% shielding.
    d. Precision video (VGA) cable shall be low noise coaxial cable with Polyethylene dielectric, foil-plus-copper braid shield, #20 awg. West Penn 258195.
    e. The floor box shall be a FSR model FL-500P-3" with the following: Trim ring shall be a model PLP; pour pan shall be a model FL-GRD4.

        1) Computer #1 VGA
        2) Computer #1 Audio
        3) Composite Audio-Video
        4) Portable video presentation input HDM1
        5) RJ-45 data jack
6. Provide audio recording for system.

2.4 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

2.5 RACEWAYS

A. Conduit and Boxes: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. 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.

C. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Wall-Mounted Outlets: Flush mounted.

D. Flush Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

E. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

G. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing public address and mass notification systems and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
4. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
5. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

D. Public address and mass notification systems will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

END OF SECTION 275117

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Coaxial cabling.
3. RS-232 cabling.
4. RS-485 cabling.
5. Low-voltage control cabling.
6. Control-circuit conductors.
7. Identification products.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. RCDD: Registered Communications Distribution Designer.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

C. 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of UTP cable for open and short circuits.

1.6 PROJECT CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Conduit and Boxes: Comply with requirements in Division 26 Section 260533 "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, Belden CDT Networking Division/NORDX or equal.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e.
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, General Purpose: Type CM or CMG.
b. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.
c. Communications, Riser Rated: Type CMR, complying with UL 1666.
d. Communications, Limited Purpose: Type CMX.

e. Multipurpose: Type MP or MPG.

2.3 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, Belden CDT Networking Division/NORDX or equal.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.4 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, Belden CDT Networking Division/NORDX or equal.

B. General Coaxial Cable Requirements: 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.

2.5 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, Emerson Network Power Connectivity Solutions; AIM Electronics brand or equal.

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.6 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

2.7 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

2.8 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.9 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, PANDUIT CORP. or equal.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section 260553 "Identification for Electrical Systems."

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Prepare test and inspection reports.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Install manufactured conduit sweeps and long-radius elbows whenever possible.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section 260533 "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

D. Pathway Installation in Equipment Rooms:

1. Extend conduits 3 inches (75 mm) above finished floor.
2. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Division 26 Section 260529 "Hangers and Supports for Electrical Systems." for installation of supports for pathways, conductors and cables.

3.3 WIRING METHOD

A. Install wiring in metal raceways and wireways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. 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.
6. 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.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations 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 (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

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 (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Division 26 Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 FIRESTOPPING

A. Comply with requirements in Division 07 Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section 260553 "Identification for Electrical Systems."

3.9 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. Visually inspect UTP and cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP 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 TIA/EIA-568-B.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.

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 280513

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Protection of existing trees indicated to remain.
2. Removal of trees and other vegetation.
3. Topsoil stripping.
4. Clearing and grubbing.
5. Removing above-grade improvements.
6. Removing below-grade improvements.

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

1. Division 31 Section "Earth Moving" for excavation, backfill and subgrade requirements.
2. Division 32 Section "Landscaping" for finish grading and topsoil requirements.

1.3 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect improvements on adjoining properties and on Owner's property.
2. Restore damaged improvements to their original condition, as acceptable to property owners.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place or relocated against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
2. Provide protection for roots over 1-1/2 inch (38 mm) in diameter that are cut during construction operations. Coat cut faces with emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Architect. Employ a licensed arborist or nurseryman to repair damage to trees and shrubs.
4. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist or nurseryman.

D. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

1.4 EXISTING SERVICES

A. General: Indicated locations are approximate; determine exact locations before commencing Work.

B. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.

C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SITE CLEARING

A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.

1. Comply with "Soil Erosion and Sedimentation Control" State of Michigan Public Act, 1972, as enforced by local agency having jurisdiction.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction. Remove broken, dead or dying branches from existing trees indicated to remain. Cut branches and roots with sharp clean pruning instruments; do not break or chop.

B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches (100 mm). Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches (50 mm) in diameter, and without weeds, roots, and other objectionable material.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.

a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.
3. Stockpile existing natural stones in areas indicated or directed for re-use on site.

C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface.
2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

a. Place fill material in horizontal layers not exceeding 6 inches (150 mm) loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.

D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

1. Abandonment or removal of certain underground pipe or conduits are indicated on site, mechanical or electrical drawings and is included under work of related Division 15 and 16 Sections. Removing abandoned underground piping or conduits interfering with construction is included under this Section.

3.2 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials and unsuitable or excess topsoil from Owner's property.

END OF SECTION 311000

SECTION 312000 – EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Preparing and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.
2. Excavating and backfilling for buildings and structures.
3. Drainage and moisture-control fill course for slabs-on-grade.
4. Subbase course for walks and pavements.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches within building lines.
7. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.

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

1. Division 0 Section "Soil Investigation Data" for soil investigation report.
2. Division 31 Section "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
3. Division 33 Section "Foundation Drainage Systems" for footings, underslab, and wall drainage.
4. Division 32 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and planting.
5. Division 3 Section "Cast-In-Place Concrete" for concrete encasings, cradles, and appurtenances for utility systems.
6. Division 1 Section "Unit Prices" for subbase and base material.
7. MDOT Standard Specification for Construction, 2012 Edition.
    a. Division 3, Bases.
    b. Division 4, Drainage Features.
    c. Division 9, Materials.

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1.3 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Aggregate Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

E. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

F. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

H. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for the following:

1. Filter fabric

C. Samples of the following:

1. 12 x 12 inch (300 x 300 mm) sample of filter fabric.

D. Test Reports: In addition to test reports required under field quality control, submit the following:

1. Test reports on borrow material.
2. Verification of the load bearing capacity of each footing.
3. Field density test reports.
4. One optimum moisture-maximum density curve for each type of soil encountered on new materials.
5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Contractor shall employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1. Before commencing earthwork, Contractor shall meet with representatives of the governing authorities, Owner, Architect, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.6 FOOTING LOADING REQUIREMENTS

A. All footings shall bear an undisturbed soil or compacted fill capable of safely sustaining bearing pressures

of a minimum of 2,500 P.S.F.

B. Bottom of footing elevations shown are approximate. If soils with the required allowable bearing capacity are not encountered at elevation shown, footing should be lowered as recommended by the Inspection Agency and approved by the Architect.

C. When soil or rock with allowable bearing capacity shown is encountered at elevation higher than the bottom of footings elevation shown the soil Inspection Agency shall contact the Architect for possible revisions to the bottom of footing elevation.

1.7 TEMPORARY MEASURES

A. Temporary Work: Shoring, sheet piling, bracing and other temporary work required to maintain stability of excavations shall be designed and engineered by a professional engineer registered in the State of Michigan. That Professional Engineer shall verify designs by signing and affixing seal, as required by the State, to drawings and calculations describing designs, and shall verify proper construction and maintenance of such temporary work by periodic signed written reports. Contractor shall determine frequency of engineer's inspection of maintenance.

1. "Temporary Work" for this purpose, is defined as work which does not form a part of the structural system of the finished work.

1.8 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided. Provide adequate means of support and protection during earthwork operations.

1. Provide a minimum 48-hours' notice to the Architect and receive written notice to proceed before interrupting any utility. Contact MISS DIG at 1-800-482-7171, 72 hours prior to excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. Satisfactory Borrow Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 inches (50 mm) in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

C. Unsatisfactory Borrow Soil Materials: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.

D. Backfill and Fill Materials: Satisfactory soil materials. MDOT Granular Material Class 2 (clean sand) under pavement and building floor areas.

E. Subbase and Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed

stone, and natural or crushed sand, ASTM D 2940, with at least 95 percent passing a 1-1/2 inch (38 mm) sieve and not more than 8 percent passing a No. 200 (75 micrometer) sieve. Crushed limestone meeting the gradation requirements of MDOT Division 8 for 23A aggregate.

F. Engineered Fill: Subbase or base materials.

1. Engineered fill as required for building footings and floor slab as indicated within the soils investigation report recommendations shall be subbase or base materials.

G. Bedding Material: Subbase or base materials with 100 percent passing a 1 inch (25 mm) sieve and not more than 8 percent passing a No. 200 (75 micrometer) sieve.

H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, meeting gradation requirements of MDOT 6A stone.

I. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2 inch (38 mm) sieve and 0 to 5 percent passing a No. 50 (300 micrometer) sieve.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, drives and walkways.

D. Tree protection is specified in the Division 2 Section "Site Clearing."

3.2 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

C. Dewatering of the septic and grey water fields shall be pumped through a filter to a certified septage hauling tanker. The septage shall be hauled and lawfully disposed at a certified septage disposal facility. The sediment from the filtration shall be disposed of at a Class II Landfill, or other facility licensed to accept the contaminated material.

3.3 EXCAVATION

A. Explosives: Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

1. Rock excavation includes removal and disposal of rock material and obstructions encountered that cannot be removed by standard excavating equipment without systematic drilling or ripping.

a. Rock material includes boulders 1/2 cu. yd. (0.38 cu. m) or more in volume and rock in beds, ledges, unstratified masses, and conglomerate deposits.

2. Rock excavation will be paid by unit prices included in the Contract Documents.

3.4 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1.2 inches (30 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Refer to Soils Report Section 00220 for additional requirements.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated by MDOT Standard Details

C. Trench Bottoms: Excavate and undercut subgrade and place bedding material to provide uniform bearing and support of pipes and conduit. Shape bedding material to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.

3.8 APPROVAL OF SUBGRADE

A. Notify Architect when excavations have reached required subgrade.

B. If Contractor encounters unsuitable or contaminated soil conditions not identified as such within the Soils Report, he/she shall immediately notify in writing the Architect of the differing site condition as required under the contract. The Architect will investigate the condition on site along with the Owner's Soils Engineer for a final determination and direction. **The Contractor shall not proceed with any excavation work he/she deems as additional work without a written Change Order or Construction Change Directive signed by the Owner and Architect. Proceeding with work considered to be additional work without a Change Order or Change Directive will be completed at the Contractor's expense**.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Refer to Soils Report Section 00220 for additional requirements.

1. Fill unauthorized excavations under other construction as directed by the Architect.

B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Testing, inspecting, and approval of underground utilities.
4. Concrete formwork removal.
5. Removal of trash and debris from excavation.
6. Removal of temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches (450 mm) of footings. Place concrete to level of bottom of footings.

C. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

D. Coordinate backfilling with utilities testing.

E. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

F. Place and compact final backfill of satisfactory soil material to final subgrade.

3.13 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

1. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and recompact to required density.

C. Place fill material in layers to required elevations for each location listed below.

1. Under grass, use satisfactory excavated or borrow soil material.
2. Under walks and pavements, use subbase or base material, or pulverized existing bituminous..
3. Under steps and ramps, use subbase material.
4. Under building slabs, use drainage fill material.
5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

a. Stockpile or spread and dry removed wet satisfactory soil material.

3.15 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557-78.

1. Under structures, building slabs, steps, and pavements, compact the top 12 inches (300 mm) below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
2. Under walkways, compact the top 6 inches (150 mm) below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
3. Under lawn or unpaved areas, compact the top 6 inches (150 mm) below subgrade and each layer of backfill or fill material at 90 percent maximum dry density.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1.0 inch.
2. Walks: Plus or minus 3/4 inch
3. Pavements: Plus or minus ½ inch.

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10 foot straightedge.

3.17 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.

1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 1557-78 dry density.
2. Shape subbase and base to required crown elevations and cross-slope grades.
3. When thickness of compacted subbase or base course is 6 inches (150 mm) or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.

3.18 DRAINAGE FILL

A. Under slabs-on-grade, place drainage fill course on prepared subgrade.

1. Compact drainage fill to required cross sections and thickness.
2. When compacted thickness of drainage fill is 6 inches (150 mm) or less, place materials in a single layer.
3. When compacted thickness of drainage fill exceeds 6 inches (150 mm) thick place materials in equal layers, with no layer more than 6 inches (150 mm) thick nor less than 3 inches (75 mm) thick when compacted.

3.19 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests.

a. Field in-place density tests may be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.

2. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Architect.
3. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet (30 m) or less of wall length, but no fewer than two tests along a wall face.
5. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet (45 m) or less of trench, but no fewer than two tests.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 312000

SECTION 312500 – SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the construction and maintenance of erosion and sediment control items as shown on the Drawings and directed by the Engineer.

1.2 RELATED SECTIONS

A. Site Clearing

B. Excavation and Backfill for Structures

C. Rock Removal

D. Grading

E. Backfill

F. Trenching

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Soil Erosion and Sediment Control:

1. Basis of Measurement: By the lump sum, otherwise incidental to the work.

2. Basis of Payment: Includes furnishing, erecting, maintaining, removing, and disposing of all erosion control items. No allowance will be made for overlaps or repairs or replacement due to damaged items caused by the Contractor's operation or negligence. Silt fence may be left in place if directed by the Engineer.

1.4 REFERENCES

A. 2012 MDOT Standard Specifications for Construction.

1.5 SUBMITTALS

A. Product data: Provide data on filter fabric, posts, and filters.

1.6 QUALITY ASSURANCE

A. As per the 2012 MDOT Standard Specifications for Construction.

C. As per Permitting / Agency Having Jurisdiction.

B. All materials shall meet the Engineer's approval.

PART 2 - PRODUCTS

2.1 SILT FENCE

A. Silt Fence: Materials for silt fence shall meet the requirements of the 2003 MDOT Standard Specifications for Construction.

2.2 INLET/CATCH BASIN FILTER

A. Manufacturers:

1. Stormwater Services Corporation
2. Atlantic Construction Fabric, Inc.
3. Approved equal.

B. Inlet/Catch Basin Filter shall be “Streamguard” as manufactured by Stormwater Services Corporation or “Siltsack” as manufactured by Atlantic Construction Fabric, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Construction of erosion and sedimentation controls shall meet the requirements of this specification, Drawings and the Engineer’s approval.

B. Install inlet/catch basin filter as per the manufacturer’s recommendations.

END OF SECTION

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes excavation support and protection systems.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls."
2. Division 31 Section "Earth Moving" for excavating and backfilling.

1.3 PERFORMANCE REQUIREMENTS

A. Design, provide, monitor, and maintain an anchored and braced excavation support and protection system capable of resisting soil and hydrostatic pressure and supporting sidewalls of excavations.

1. Work includes removing excavation support and protection systems when no longer needed.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by excavation support and protection systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.

1. Engineering Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of data for the excavation support and protection system including drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by the Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project Site Information: The geotechnical report is included elsewhere in Project Manual. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials need not be new but must be in serviceable condition.

B. Structural Steel: ASTM A 36 (ASTM A 36M).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Locate excavation support and protection systems clear of permanent construction and to permit forming and finishing of concrete surfaces.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

END OF SECTION 315000

SECTION 321216 - HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt patching.
3. Pavement-marking paint.

B. Related Sections include the following:

1. Division 32 Section “Portland Cement Concrete Paving” for concrete curbing and walks.

1.3 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the State of Michigan Department of Transportation (MDOT) Standard Specifications for Construction, 2012 Edition.

1.4 SUBMITTALS

A. Product Data: For each product specified. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.

C. Testing Agency Qualifications: Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

D. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations in accordance with MDOT Standard Specifications for Construction, 2012 Edition.

B. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or crushed limestone complying with MDOT Standard Specifications, Division 9.0.

C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, or combinations thereof; complying with MDOT Standard Specifications, Division 9.0.

1. For hot-mix asphalt, limit natural sand to a maximum of 10 percent by weight of the total aggregate mass.

2.2 ASPHALT MATERIALS

A. Asphalt Cement: ASTM D 3381 for viscosity-graded material.

B. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

C. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.

1. Color: Blue (for barrier-free parking spaces).
2. Color: Yellow (for standard spaces and dividing lines on drives).

2.4 MIXES

A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes in accordance with MDOT Standard Specifications, Division 5.

B. Provide mixes as show on plans and specifications.

1. Leveling Course: MDOT No. 3C
2. Surface Wearing Course: MDOT No.13A

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Architect/Engineer in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 PATCHING, REPAIRS AND SEAL COATING

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.
2. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix in accordance with MDOT Standard Specification, Division 5.

3.4 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Refer to MDOT Standard Specifications, Division 5.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive

displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers. Refer to MDOT Standard Specifications, Division 5.

1. Average Density: 98 percent of reference laboratory density according to ASTM D 1559, but not less than 97 percent nor greater than 100 percent.

B. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

C. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

D. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 3/4 inch (20 mm)
2. Leveling Course: Plus or minus 1/4 inch (6 mm)..
3. Surface Course: Plus 1/8 inch (3 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the tolerances as specified in MDOT Standard Specifications, Division 4 using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

3.7 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to cure for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply per MDOT Standard Specifications, Division 8.0.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.

1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.

a. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216

SECTION 321313 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes exterior portland cement concrete paving for the following:

1. Curbs and gutters.
2. Walkways and drives.
3. Joint Sealants

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

1. Division 31 Section "Earth Moving" for subgrade preparation, grading and subbase course.
2. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.
3. MDOT Standard Specifications for Construction, 2012 Edition, Division 6 "Portland Cement Concrete Pavements", Division 8 "Incidental Construction", Division 9 "Materials".

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, joint sealants, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

D. Laboratory test reports for evaluation of concrete materials and mix design tests.

1.4 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. Michigan Department of Transportation, Standard Specifications for Construction, 2012 Edition.
2. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
3. ACI 318, "Building Code Requirements for Reinforced Concrete."
4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.

B. Welded Steel Wire Fabric: ASTM A 185.

1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.

C. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.

2.3 CONCRETE MATERIALS

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

1. All concrete materials shall comply with MDOT Standard Specifications, Division 7.
2. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type F.

C. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source.

1. Maximum Aggregate Size: MDOT 6A Stone.
2. Do not use fine or coarse aggregates that contain substances that cause spalling.

D. Water: Potable.

2.4 ADMIXTURES

A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Air-Entraining Admixture:

a. Air-Tite or Amex 210; Cormix Construction Chemicals.
b. Air-Mix or Perma-Air; Euclid Chemical Co.
c. Darex AEA or Daravair; W.R. Grace & Co.
d. MB-VR or Micro-Air; Master Builders, Inc.
e. Sealtight AEA; W.R. Meadows, Inc.
f. Sika AER; Sika Corp.

2. Water-Reducing Admixture:

a. Chemtard; ChemMasters Corp.
b. Type A Series; Cormix Construction Chemicals.
c. Eucon WR-75; Euclid Chemical Co.
d. WRDA; W.R. Grace & Co.
e. Pozzolith Normal or Polyheed; Master Builders, Inc.
f. Metco W.R.; Metalcrete Industries.
g. Plastocrete 161; Sika Corp.

2.5 CURING MATERIALS

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

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. White burlap-polyethylene sheet.

C. Evaporation Control: White membrane curing compound, ASTM C309, Type 2, Class B Vehicle.

D. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Evaporation Control:

a. Aquafilm; Conspec Marketing and Mfg. Co.
b. Eucobar; Euclid Chemical Co.
c. E-Con; L&M Construction Chemicals, Inc.
d. Confilm; Master Builders, Inc.
e. Waterhold; Metalcrete Industries.

2.6 CONCRETE MIX

A. Concrete mix shall be designed in accord with MDOT Standard Specifications 7.01. Grade of concrete shall be 35S.

1. Compressive Strength (28-Day): 3500 psi.
2. Slump Limit at Point of Placement: 3 inches.

B. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1-1/2 percent:

1. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.8 JOINT SEALANTS

A. Compatibility: Provide joint sealants, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

1. Color:

a. Provide selections made by Architect from manufacturer’s full range of standard colors for products of type indicated.

B. Silicone Sealant for Concrete: One-part, low modulus, neutral-cure silicone sealant complying with ASTM C 920 for Type S, Grade as indicated below, Class 25 and as follows:

1. Use Related to Exposure (As Recommended by Manufacturer): Use T
2. Grade P for joints in horizontal paved surfaces.
3. Additional capability, when tested for adhesion and cohesion under maximum cycle movement per ASTM C 719, to withstand the following percentage changes in joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920 for Uses indicated:

a. 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.

4. Grade P Silicone Sealant for Concrete:

a. “Roadsaver Silicone SL,” Crafco, Inc.
b. Dow Corning 888-SL,” Dow Corning Corp.

2.9 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. Backer Rods for Cold-Applied Sealants: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible, plastic foam of material indicated below and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas and nonoutgassing in unruptured state.
2. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 gram/cubic centimeter per ASTM C 1083.
3. Either material indicated above.

C. 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.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.
2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise. Frequency of joints shall be per MDOT Standard Details.

1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.

1. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.

D. Expansion Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet, unless indicated otherwise.
2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Joint Sealants:

1. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.
2. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer.
3. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer’s recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.

F. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

G. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

H. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

I. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

J. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

K. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will

not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.

B. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 3/8 inch.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by using curing compound.

1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer’s printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce to cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

a. Do not leave gaps between ends of joint fillers.
b. Do not stretch, twist, puncture or tear joint fillers.
c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer

3.9 FIELD QUALITY CONTROL TESTING

A. Contractor shall employ a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement as follows:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.
c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

B. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

D. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 329300 - LANDSCAPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Trees.
2. Shrubs.
3. Ground covers.
4. Plants.
5. Lawns.
6. Topsoil and soil amendments.
7. Fertilizers and mulches.
8. Stakes and guys.
9. Landscape edgings.

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

1. Division 31 Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
2. Division 31 Section "Earthwork" for excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.
3. Michigan Department of Transportation Standard Specifications for Construction, 2012 Edition, Division 8, Landscaping.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.
2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
3. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

C. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for sod, identifying sod source, including name and telephone

number of supplier.

D. Samples of each of the following:

1. 5 lb (2 kg) of mineral mulch for each color and texture of stone required for Project, in labeled plastic bags.
2. 5 lb (2 kg) of organic mulch in labled plastic bag.
3 Edging materials and accessories to verify color selected.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.

F. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.

1. Analysis of existing surface soil.
2. Analysis of imported topsoil.

G. Planting schedule indicating anticipated dates and locations for each type of planting.

H. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

B. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."

C. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.

D. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

C. Sod: Harvest, deliver, store, and handle sod according to the requirements of the American Sod Producers Association's (ASPA) "Specifications for Turfgrass Sod Materials and Transplanting/Installing."

D. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.

E. Handle balled and burlapped stock by the root ball.

F. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.6 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of two growing seasons after date of Substantial Completion for each Phase, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.

1. Trees.
2. Shrubs.

3. Ground covers.
4. Relocated existing on-site trees.

C. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season.

D. Replace planting materials that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

E. A limit of one replacement of each plant material will be required, except for losses or replacements due to failure to comply with requirements.

1.9 TREE AND SHRUB MAINTENANCE

A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Maintain trees and shrubs for the following period:

1. Maintenance Period: 12 months following Substantial Completion.

1.10 GROUND COVER AND PLANT MAINTENANCE

A. Maintain ground cover and plants by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings for the following period:

1. Maintenance Period: 6 months following Substantial Completion.

1.11 LAWN MAINTENANCE

A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days after date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.

2. Sodded Lawns: 30 days after date of Substantial Completion.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm).

1. Water lawn at the minimum rate of 1 inch (25 mm) per week.

D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass

is wet.

E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

D. Mark with paint on the trunk, the orientation of shade trees as grown in the nursery, i.e. ‘north’.

2.2 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required.

1. Branching Height: 1/2 of tree height.

B. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, and stem form as follows:

1. Form: Multistem, clump, with 2 or more main stems.
2. Form: Multistem, shrub, with multiple stems.

C. Provide balled and burlapped trees.

1. Container-grown trees will be acceptable in lieu of balled and burlapped trees subject to meeting ANSI Z60.1 limitations for container stock.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

B. Provide balled and burlapped deciduous shrubs.

1. Container-grown deciduous shrubs will be acceptable in lieu of balled and burlapped deciduous

shrubs subject to meeting ANSI Z60.1 limitations for container stock.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.

B. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens of the following grade:

1. Heavy Grade: "XX."

C. Provide balled and burlapped coniferous evergreens.

1. Container-grown coniferous evergreens will be acceptable in lieu of balled and burlapped coniferous evergreens subject to meeting ANSI Z60.1 limitations for container stock.

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.

B. Provide balled and burlapped broadleaf evergreens.

1. Container-grown broadleaf evergreens will be acceptable in lieu of balled and burlapped broadleaf evergreens subject to meeting ANSI Z60.1 limitations for container stock.

2.6 GROUND COVERS AND PLANTS

A. Provide ground covers and plants established and well rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required by ANSI Z60.1 for the pot size indicated.

2.7 GRASS MATERIALS

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

1. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated below:

B. Sun and Partial Shade: Provide certified grass-seed blends or mixes, proportioned by weight, as indicated on the Landscape Plan.

Name	Min. Pct. Germ.	Min. Pct. Pure Sd.	Max. Pct. Weed Sd.
Kentucky bluegrass (Poa pratensis)	80	85	0.50
Chewings red fescue (Festuca rubra variety)	85	98	0.50

Perennial rye grass (Lolium perenne)	90	98	0.50

C. Sod: Certified turfgrass sod complying with ASPA specifications for machine-cut thickness, size, strength, moisture content, and mowed height, and free of weeds and undesirable native grasses. Provide viable sod of uniform density, color, and texture of the following turfgrass species, strongly rooted, and capable of vigorous growth and development when planted. 40% Fine Fescue
60%Kentucky Bluegrass Blend

2.8 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

2.9 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.

B. Aluminum Sulfate: Commercial grade, unadulterated.

C. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

1. When site treated, mix with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cu. ft. (cu. m) of loose sawdust or ground bark.

F. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

G. Herbicides: EPA registered and approved, of type recommended by manufacturer.

H. Water: Potable.

2.10 FERTILIZER

A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

1. Composition: 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 5 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight.

2.11 MULCHES

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Ground or shredded bark.

B. Peat Mulch: Provide peat moss in natural, shredded, or granulated form, of fine texture, with a pH range of 4 to 6 and a water-absorbing capacity of 1100 to 2000 percent.

C. Fiber Mulch: Biodegradable dyed-wood cellulose-fiber mulch, nontoxic, free of plant growth- or germination-inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

D. Asphalt Emulsion Tackifier: Asphalt emulsion, ASTM D 977, Grade SS-1, nontoxic and free of plant growth- or germination-inhibitors.

E. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, nontoxic and free of plant growth- or germination-inhibitors.

F. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type and color:

1. Type: Rounded riverbed gravel or smooth-faced stone, 1-1/2 inches (38 mm) maximum, 3/4 inch (19 mm) minimum, readily available natural gravel color range.
2. Type: Lava rock, red, crushed.

2.12 WEED-CONTROL BARRIERS

A. Nonwoven Fabric: Polypropylene or polyester fabric, 3.8 oz. per sq. yd. minimum.

2.13 EROSION-CONTROL MATERIALS

A. Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, 0.92 lb per sq. yd. (0.5 kg per sq. m) minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

2.14 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-Sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches (50 by 50 mm) by length indicated, pointed at one end.

B Guy and Tie Wire: ASTM A 641 (ASTM A 641M), Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter for 2-1/2 inch diameter and larger deciduous trees and all evergreen trees, 0.080 inch (2 mm) for 2 inch diameter and smaller deciduous trees..

C Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.

D Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.15 LANDSCAPE EDGINGS

A. Aluminum Edging: Standard profile extruded-aluminum edging, ASTM B 221 (ASTM B 221M), alloy 6061-T6, fabricated in interlocking sections with loops stamped from face of sections approximately 24 inches (600 mm) apart to receive stakes.

1. Edging Size: 3/16 inch (4.8 mm) wide by 5-1/2 inches (140 mm) deep.
2. Stakes: Aluminum, ASTM B 221 (ASTM B 221M), alloy 6061-T6, approximately 1-1/2 inches (38 mm) wide by 12 inches (300 mm) long.
3. Finish: Mill finish.

2.16 MISCELLANEOUS MATERIALS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's instructions.

B. Burlap: Minimum 4 inches (102 mm) wide for tree protection during delivery only.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, and secure Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

B. Root prune existing trees to be relocated prior (6 months minimum) to moving.

3.3 PLANTING SOIL PREPARATION

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials

harmful to plant growth.

B. Mix soil amendments and fertilizers with topsoil at recommended quantities. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days. Add other soil amendments or modify mix, if required, based on evaluation of topsoil analysis, to produce a satisfactory topsoil.

C. For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.

D. For planting beds and lawns, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

1. Mix lime with dry soil prior to mixing fertilizer. Prevent lime from contacting roots of acid-tolerant plants.

3.4 LAWN PLANTING PREPARATION

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

C. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.

1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.
2. Allow for sod thickness in areas to be sodded.

D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:

1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
2. Till surface soil to a depth of at least 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.

E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.

F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.5 GROUND COVER AND PLANT BED PREPARATION

A. Loosen subgrade of planting bed areas to a minimum depth of 6 inches (150 mm). Remove stones larger

than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

B. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.

3.6 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.

1. Balled and Burlapped Trees and Shrubs: Excavate approximately two times as wide as ball diameter and equal to ball depth, plus the following setting layer depth:

a. Setting Layer: Allow 6 inches (150 mm) of planting soil.

2. Container-Grown Trees and Shrubs: Excavate approximately two times container width, plus the following setting-layer depth:

a. Setting Layer: Allow 6 inches (150 mm) of planting soil.

3. Where drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.

B. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil or use as backfill.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

E. Fill excavations with water and allow to percolate out, before placing setting layer and positioning trees and shrubs.

3.7 PLANTING TREES AND SHRUBS

A. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated. Orientation shall be the same as the nursery grown orientation.

1. Place stock on setting layer of compacted planting soil.
2. Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.
3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

B. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Carefully remove containers so as not to damage root balls.
2. Place stock on setting layer of compacted planting soil.
3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

C. Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.

3.8 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are size after pruning.

3.9 TREE AND SHRUB GUYING AND STAKING

A. Upright Staking and Tying: Stake deciduous trees of 2- through 5-inch (50- through 125-mm) caliper unless otherwise indicated. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Guying and Staking: Guy and stake evergreen trees exceeding 7 feet (2.1 m) and deciduous trees more than 2-inch (50-mm) caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches (760 mm) long, driven to grade. Attach flags to each guy wire, 30 inches (760 mm) above finish grade.

3.10 PLANTING GROUND COVER AND PLANTS

A. Space ground cover and plants not more than 24 inches (600 mm) apart.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.11 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated. Do not place mulch in contact with trunks of trees. Provide 2"-3" clearance.

B. Weed-Control Barriers: Install the following weed-control barriers according to manufacturer's recommendations, before placing natural stone or organic mulch. Completely cover area lapping edges a minimum of 6 inches (150 mm).

1. Material and Seam Treatment: Nonwoven fabric with seams pinned.

C. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

1. Thickness: 5 inches (125 mm).

D. Mineral Mulch: Apply the following average thickness of mineral mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

1. Thickness: 4 inches (100 mm).

3.12 SEEDING NEW LAWNS

A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. Sow seed at the following rates:

1. Seeding Rate: 5 to 8 lb per 1000 sq. ft. (2.5 to 4 kg per 100 sq. m).

C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.

D. Protect seeded slopes exceeding 1:4 against erosion with erosion-control blankets installed and stapled according to manufacturer's recommendations.

E. Protect seeded areas with slopes less than 1:4 against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre (45 kg per 100 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into topsoil by suitable mechanical equipment.

3.13 HYDROSEEDING NEW LAWNS

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Apply slurry uniformly to all areas to be seeded in a 1-step process. Apply mulch at the minimum rate of 1500 lb per acre (16.5 kg per 100 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate.

3.14 SODDING NEW LAWNS

A. Lay sod within 24 hours of stripping. Do not lay sod if dormant or if ground is frozen.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:4 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below the sod.

3.15 RECONDITIONING LAWNS

A. Recondition existing lawn areas damaged by Contractor's operations, including storage of materials or equipment and movement of vehicles. Also recondition lawn areas where settlement or washouts occur or where minor regrading is required.

1. Recondition other existing lawn areas.

B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

C. Where substantial lawn remains, mow, dethatch, core aerate, and rake. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

D. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of it off the Owner's property.

E. Till stripped, bare, and compacted areas thoroughly to a depth of 6 inches (150 mm).

F. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Provide new planting soil as required to fill low spots and meet new finish grades.

G. Apply seed and protect with straw mulch as required for new lawns.

H. Apply sod as required for new lawns.

I. Water newly planted areas and keep moist until new grass is established.

3.16 INSTALLATION OF EDGINGS

A. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's recommendations. Anchor with aluminum stakes spaced approximately 24 inches (600 mm) apart, driven below top elevation of edging.

3.17 INSTALLATION OF MISCELLANEOUS MATERIALS

A. Apply antidesiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.

1. When deciduous trees or shrubs are moved in full-leaf, spray with antidesiccant at nursery before moving and again 2 weeks after planting.

3.18 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

3.20 PLANTING SOIL AMENDMENTS SCHEDULE

A. Tree Pits or Trenches: Provide soil amendments in not less than the following quantities:

1. Ratio of loose peat humus to topsoil by volume: 1:2
2. Weight of lime per cu. ft. (cu. m) of backfill: Based on Soil Analysis
3. Weight of bonemeal per cu. ft. (cu. m): Based on Soil Analysis
4. Weight of superphosphate per cu. ft. (cu. m): Based on Soil Analysis
5. Weight of potash per cu. ft. (cu. m): Based on Soil Analysis
6. Weight of commercial fertilizer per cu. ft. (cu. m): 0.6 lbs

B. Ground Cover and Planting Beds: Provide soil amendments in not less than the following quantities:

1. Ratio of loose peat humus to topsoil by volume: 1:2
2. Weight of lime per 1000 sq. ft. (100 sq. m): Based on Soil Analysis
3. Weight of bonemeal per 1000 sq. ft. (100 sq. m): Based on Soil Anlaysis
4. Weight of superphosphate per 1000 sq. ft. (100 sq. m): Based on Soil Analysis
5. Weight of potash per 1000 sq. ft. (100 sq. m): Based on Soil Analysis
6. Weight of commercial fertilizer per 1000 sq. ft. (100 sq. m): 10 lbs

C. Lawns: Provide soil amendments in not less than the following quantities:

1. Ratio of loose peat humus to topsoil by volume: 1:2
2. Weight of lime per 1000 sq. ft. (100 sq. m): 100 lbs
3. Weight of bonemeal per 1000 sq. ft. (100 sq. m): Based on Soil Analysis
4. Weight of superphosphate per 1000 sq. ft. (100 sq. m): Based on Soil Analysis
5. Weight of potash per 1000 sq. ft. (100 sq. m): Based on Soil Analysis
6. Weight of commercial fertilizer per 1000 sq. ft. (100 sq. m): 10 lbs

END OF SECTION 329300

SECTION 3346001 - FOUNDATION DRAINAGE SYSTEMS

PART 2 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

B. This Section includes foundation, subsoil drainage systems.

C. This Section includes underslab, subsoil drainage systems.

D. This Section includes foundation and underslab, subsoil drainage systems.

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

1. Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
2. Division 33 Section "Sanitary Sewerage " for connections to storm drainage systems.
3. Division 15 Section "Plumbing Piping" for connections to building storm drains.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for the following:

1. Perforated piping.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed foundation drainage systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.5 COORDINATION

A. Coordinate foundation drainage system installation with excavating, trenching, and backfilling.

B. Coordinate drainage panel installation with waterproofing of walls below grade.

C. Coordinate piping termination with storm drainage system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements.

2.2 PIPES AND FITTINGS

A. General: Include pipes, fittings, couplings, and joint materials.

B. Perforated, Polyethylene (PE) Pipe and Fittings: ASTM F 405, corrugated, for coupled joints.

1. Couplings: Manufacturer's standard, band type.
2. Sock Filter: Provide all drainage piping with continuous protective 100% spun-bonded nylon sock (wrap). Water flow rate shall be equivalent to 530 gpm per sq. ft. at 3" head ADSTM 100.

C. Ductile Iron conforming to AWWA C151

2.3 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53; Type F or Type E, Grade A; Schedule 40; galvanized.

B. Cast-Iron Pipe Sleeves: ASTM A 74, Service class, cast-iron soil pipe.

2.4 SOIL MATERIALS

A. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Size No. 57, with 100 percent passing 1-1/2-inch (37.5-mm) sieve and not more than 5 percent passing No. 8 (2.36-mm) sieve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where foundation drainage systems are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 FOUNDATION DRAINAGE SYSTEM APPLICATIONS

A. Systems with 4-Inch (DN 100) Piping: As follows:

1. Perforated, polyethylene (PE) pipe and fittings, couplings, and coupled joints.

3.3 PIPING INSTALLATION

A. Drawing plans and details indicate general location and arrangement of foundation drainage system piping.

B. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing, solidly in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Install piping pitched down in direction of flow, at a minimum slope of 1 percent (1:100) and with a minimum cover of 36 inches (1000 mm), except where otherwise indicated.
2. Lay open-joint tile spaced as indicated on Drawings or, if not indicated, with 1/4-inch (6-mm) space between ends. Cover top 2/3 of joint opening with joint screening material and tie with corrosion-resistant wire.
3. Provide recesses in excavation bottom to receive bells of pipe bell ends. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
4. Apply and compact impervious fill material to raise low areas or where unsatisfactory bearing soil may occur.

C. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

D. Maintain swab or drag in piping with tight joints and pull past each joint as it is completed.

E. Extend piping and connect to storm drainage system, of sizes and in locations indicated. Terminate piping as indicated.

F. Extend piping and connect to building storm drains, of sizes and in locations indicated. Terminate piping as indicated.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings as indicated and according to the following.

B. Polyethylene (PE) Pipe and Fittings: As follows:

1. Join pipe, tubing, and fittings with couplings for soiltight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; and manufacturer's written instructions.
2. Join perforated pipe and fittings with couplings for soiltight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; or ASTM D 2321; and manufacturer's written instructions.
3. Install according to ASTM D 2321 and manufacturer's written instructions.
4. Install perforated pipe with perforations down.

C. Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.5 SLEEVE INSTALLATION

A. Install sleeves in locations and at elevations indicated.

3.6 SOIL MATERIAL INSTALLATION

A. Filtering Material: Place supporting layer of filtering material over compacted subgrade where drainage pipe is to be laid to depth indicated or, if not indicated, to compacted depth of not less than 4 inches (100 mm).

B. Fill to Grade: Place impervious fill material over flowable fill mix. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish elevations and slope away from building.

3.7 FIELD QUALITY CONTROL

A. Testing: Test drain piping with water or visually check piping to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

1. Place additional filtering material to depth of 4 inches (100 mm) around sides and top of drains after testing.

END OF SECTION 334600

EXHIBIT “A” – ST. CLAIR COUNTY LOCAL CONTRACTOR LIST

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Raymond Excavating LLC
800 Gratiot Blvd
Marysville, MI 48040

Morgan Excavating LLC
4755 Walker Road
Clyde, MI 48049

Teltow Contracting
4678 Meldrum
Casco, MI 48064

Schroeder Masonry
4600 Norman Road
Burtchville, MI 48059

Clyde Concrete and Masonry
6486 Lakeshore
Burtchville, MI 48059

Beem Construction
327 Huron
Port Huron, MI 48060

East Lake Builders
410 Water
Port Huron, MI 48060

Richards Construction
2243 Wadhams Road
Kimball, MI 48074

Woolman and Sons
4104 Bonisteel
Fort Gratiot, MI 48059

Ainsworth Door Inc.
3928 Krafft
Fort Gratiot, MI 48059

Overhead Door of St. Clair County
5400 Lapeer
Kimball, MI 48074

Shoreline Building Products
5805 Lakeshore
Fort Gratiot, MI 48059

Lowes Fort Gratiot
4200 24th Avenue
Fort Gratiot, MI 48059

Home Depot Fort Gratiot
4195 24th Avenue
Fort Gratiot, MI 48059

Custom Glass
2950 Cherry Hill
Fort Gratiot, MI 48059

Port Huron Glass
4120 Lapeer
Port Huron, MI 48060

Wadhams Fence
1136 Wadhams
Kimball, MI 48074

SB Heating
3704 Keewahdin
Fort Gratiot, MI 48059

Harrington Plumbing
7141 State
Burtchville, MI 48059

Ainsworth Electric
3763 Lapeer
Port Huron, MI 48059

SOS Insulation
8640 Lake Pleasant
Clifford, MI 48727

Dyck Security Service
2425 Minnie
Port Huron, MI 48060

BSB Communications
2929 Lapeer
Port Huron, MI 48060

RESA IT
499 S. Range
Marysville, MI 48040

Signs Plus
3020 Simpson
Fort Gratiot, MI 48059

Parraghi Roofing & Sheet Metal LLC
5543 Galbrath Line
Croswell, MI 48422

Metal Masters Construction
951 24th Street
Port Huron, MI 48059

McIntyre Asphalt Paving
4485 Parker
Fort Gratiot, MI 48059

Hess Asphalt
6330 Lapeer
Clyde, MI 48049

JSM Landscaping
101 Rella Rae Avenue
Marysville, MI 48040

Independent Floor Covering
3842 Pine Grove
Fort Gratiot, MI 48059

Jones Equipment Rental
4600 24th Avenue
Fort Gratiot, MI 48059

Port Huron Drywall
3159 Keewahdin
Fort Gratiot, MI 48059

Eagen Drywall
420 Huron
Marysville, MI 48040

Blue Water Painting
4709 State
Fort Gratiot, MI 48059

Robert Koppel Contractor
1530 11th Avenue
Port Huron, MI 48060

Mortimer Lumber
2307 Lapeer
Port Huron, MI 48060

Countertops Direct
3841 Pine Grove
Fort Gratiot, MI 48059

Masters Plumbing
2630 25th Street, Suite A
Port Huron, MI 48060

Postill Electric
4300 E. Range Court
St. Clair, MI 48079

Flooring Edge
5155 Lapeer
Kimball, MI 48074

Marshall E. Campbell Company
2975 Lapeer
Port Huron, MI 48060

Campbell Shaw Steel
1705 Michigan
Marysville, MI 48040

K E Electrical Supply
3450 Lapeer
Port Huron, MI 48060

Medler Electric Company
815 24th Avenue
Port Huron, MI 48060

Lashbrook Electric
2933 Eastland Drive
Port Huron, MI 48060

Stephenson Electric
2545 24th Street
Port Huron, MI 48060

Gate Construction LLC (roofing)
2801 Riverside Drive
Port Huron, MI 48060

Salski Construction, LLC
650-6901 (General)
Hewitt Road
Avoca, MI 48006

Dan Halliday Painting
300-3800
Port Huron, MI 48060

Countryside Plumbing
Ruby, MI 48049

Port Huron Fence Co.
2240 10th Street
Port Huron, MI 48060

Dependable Heating & Cooling (HVAC)
2302 Wadhams Road
Kimball, MI 48074

Yale Heating & Air Conditioning
PO Box 56
Yale, MI 48097
Phone: 810-982-4550

Vandergraff Construction
4473 Lakeshore Road
Lexington, MI 48450
Phone: 810-359-7179

Jeff Kern, Builder
3930 Tamarack
Port Huron, MI 48060
Phone: 810-841-1863

Bussey Construction
1800 Sheridan Line Road
Croswell, MI 48422
Phone: 810-304-1033

Dan Curtis, Builders
3395 Woodview Drive
North Street, MI 48049
Phone: 810-982-5552

Highgrade Materials – Concrete
Formerly Black River Concrete
5288 Lapeer Road
Kimball, MI 48074
Phone: 810-982-0108

Vern Morley
5941 Beard Road
North Street, MI 48049
Phone: 810-650-7458

McKenzie Concrete
4080 Vincent Road
North Street, MI 48049
Phone: 810-989-9065

Mike Hayes Roofing
4098 Old Froge Drive
Ft. Gratiot, MI 48059
Phone: 810-984-4564

Gates Construction, Roofing
2801 Riverside Drive
Port Huron, MI 48049
Phone: 810-984-9047

Reasonable Roofing
1725 Michigan Road
Port Huron, MI 48060
Phone: 810-984-3420

Zimmer Roofing
133 Runnels Street
Port Huron, MI 48060
Phone: 810-966-6991

Dependable Heating & Cooling
2302 Wadhams Road
Kimball, MI 48074
Phone: 810-479-0750

Vincents Heating & Cooling
And Plumbing
2560 Oak St.
Port Huron, MI 48060
Phone: 810-985-7103

Bowerman Plumbing, LLC
5152 Burtch Road
Jeddo, MI 48032
Phone: 810-327-1400

Masters Plumbing
Rod Arquette
2630 25th Street, Suite A
Port Huron, MI 48060
Phone: 810-985-8207

Stephenson Electric
2545 24th Street
Port Huron, MI 48060
Phone: 810-987-5777

Insulation Plus
2645 N. Range Road
Kimball, MI 48074
Phone: 810-956-8700

Sweeney Restoration
2514 Chestnut St (Painting)
Port Huron, MI 48060
Phone: 810-292-0525

Souilliere Drywall
5526 Flinchbaugh
Kimball, MI 48074
Phone: 810-987-6533

Ben's Lumber Co.
4448 Main Street
Brown City, MI 48416
Phone: 810-346-2835

ABC Supplies
(shingles and supplies)
2650 Howard Street
Port Huron, MI 48060
Phone: 810-987-7300