PROJECT MANUAL

DRAW PROJECT NUMBER: 21-U04-01

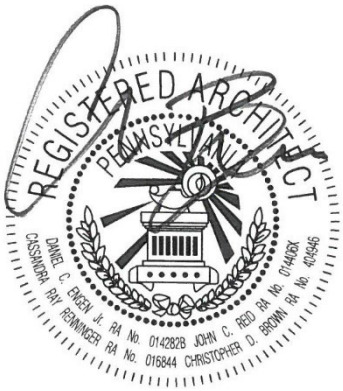
CHEM LAB RENOVATIONS
SCIENCE INNOVATION CENTER

161 Community College Drive
Youngwood, PA 15697

OWNER: Westmoreland County Community College
145 Pavilion Lane
Youngwood, PA 15697

ARCHITECT: DRAW Collective
470 Washington Road
Pittsburgh, PA 15228

MECHANICAL / PLUMBING / ELECTRICAL ENGINEER: Tower Engineering
115 Evergreen Heights Dr., Suite 400
Pittsburgh, PA 15229



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Designing places that matter, together.

470 Washington Road | Pittsburgh, PA 15228 | 412.561.7117 | DRAWcollective.com

DRAW COLLECTIVE Architecture

[redacted] REQUEST FOR INFORMATION FORM (DOCUMENT 00 2116)			
Project:	**CHEM LAB RENOVATIONS, SCIENCE INNOV. CENTER WESTMORELAND COUNTY COMMUNITY COLLEGE**	**Date:**	
DRAW Project No.:	**DRAW Collective Project No. 21-U04-01**	**To:**	Jennifer Skripac jennifers@drawcollective.com
Contract No.:	**#1019**	**CC:**	chrisb@drawcollective.com
Contract Type: (Circle One)	◉GC ◯PC ◯MC ◯EC ◯		
From:			
Company Name:		E-mail:	
Contact Person:		Telephone:	

PLEASE USE ONE RFI FORM PER QUESTION

Section/ Drawing No.	

Response			
Name:			
Company:		Date:	

DRAW Collective USE			**No:**
Date Received:	Date Forwarded:	Forwarded To:	

SECTION 00 5213 - AGREEMENT

PART 1 - GENERAL

1.1 DOCUMENTS

A. "Standard Form of Agreement Between Owner and Contractor", AIA Document A101-2017, Articles 1 through 9 inclusive, standard form as amended for this project, will form the basis of Contract between the Owner and Contractor.

B. Additions or revisions to standard form text, are incorporated in the modified Document A101 attached.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

DOCUMENT CONTINUES ON NEXT PAGE

DRAFT

AIA® Document A101® – 2017

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

AGREEMENT made as of the «TBD » day of «TBD » in the year « 2025 »
(In words, indicate day, month and year.)

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

Westmoreland County Community College
145 Pavilion Lane
Youngwood, PA 15697

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

TBD
« »
« »
« »

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

WCCC RFP No. 1019
Project No. 21-U04-01
Chem Lab Renovations
Science Innovation Center
161 Community College Drive
Youngwood, PA 15697

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

DRAW Collective
470 Washington Road
Pittsburgh, PA 15228
Telephone: 412-561-7117
Email: cbrown@drawcollective.com

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.

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

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, 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.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

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: A date set forth in a notice to proceed issued by the Owner.

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

§ 3.3 Substantial Completion of the Project or Portions Thereof

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work as stated in the Project Manual Section 01 1100 “SUMMARY”, subject to adjustments of this Contract Time as provided in the Contract Documents.

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates as stated in the Project Manual Section 01 1100 “SUMMARY”, subject to adjustments of this Contract Time as provided in the Contract Documents.

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

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 « TBD » ($ « TBD »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
TBD	TBD

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price
None	None

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

Item	Units and Limitations	Price per Unit ($0.00)
TBD	TBD	TBD

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

None.

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 «first » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the «fifteenth » day of the «following » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than «forty five » («45 ») 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 of values 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 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 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; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Ten percent (10%)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

All items subject to retainage

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

Retainage at 10% until Project is 51% complete. Thereafter, retainage at 5% until Project reaches Full and Final Completion. Owner reserves the right at all times to withhold an amount, in its discretion, that is sufficient to complete and / or correct Contractor's Work.

§ 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 Article 12 of AIA Document A201–2017, 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.

§ 5.3 Interest

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.)

« 6 » % « simple interest »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the 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.)

This space left blank.

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[«X »] Litigation in the Court of Common Pleas of Westmoreland County, PA

If the Owner and Contractor do not select a method of binding dispute resolution, 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.

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 A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

The Contractor shall be entitled to receive payment for all accepted and / or approved work, and expenses actually earned and incurred.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

Joshua Howell, Director of Purchasing

Westmoreland County Community College
145 Pavilion Lane
Youngwood, PA 15697
Phone: 724-925-4093
Email howelljo@westmoreland.edu

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

TBD

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A201™–2017, General Conditions and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A201™–2017 and elsewhere in the Contract Documents.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A201™–2017, General Conditions of the Contract for Construction

.3 Drawings

Number
All drawings identified on Cover Sheet 001, and as modified by Addenda.

.4 Specifications

Section
All Documents and Sections identified in the Project Manual, Table of Contents Document 00 0110, and as modified by Addenda.

.5 Addenda, if any:

Number	Date	Pages
TBD	TBD	TBD

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

.7 Other Exhibits:

Document	Title	Date	Pages
None			

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« None »

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

OWNER *(Signature)*

Westmoreland County Community College
(Printed name and title)

CONTRACTOR *(Signature)*

TBD
(Printed name and title)

SECTION 00 7213 - GENERAL CONDITIONS

PART 1 - GENERAL

1.1 DOCUMENTS

A. "General Conditions of the Contract for Construction", AIA Document A201-2017, Articles 1 through 16 inclusive, as modified for this Project, attached following this document, will be incorporated as part of the Contract.

B. Supplementary Conditions of the Contract, in the form of additions or revisions to standard form text, are integral with the modified Document A201 attached.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

DOCUMENT CONTINUES ON NEXT PAGE

DRAFT

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

WCCC RFP No. 1019
Project No. 21-U04-01 Chem Lab Renovations, Science Innovation Center
161 Community College Drive
Youngwood, PA 15697

THE OWNER:
(Name, legal status and address)

Westmoreland County Community College
145 Pavilion Lane
Youngwood, PA 15697

THE ARCHITECT:
(Name, legal status and address)

DRAW Collective
470 Washington Road
Pittsburgh, PA 15228
Telephone: 412-561-7117
Email: chrisb@drawcollective.com

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12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

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.

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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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 or proposal requirements. The Contract Documents executed or identified in accordance with Subparagraph 1.2.1 shall prevail in case of an inconsistency with subsequent versions made through manipulable electronic operations involving computers

§ 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.

§ 1.1.2.1 "Separate Contractor" shall mean a separate contract awarded by the Owner for certain construction operations at the site, that is not otherwise identified as a Prime Contractor. Separate Contracts if known at the time of bidding, are identified in the "Summary" Section 01 1000 of the Project Manual. Otherwise, the Owner may award separate contracts in the course of the work.

§ 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.

§1.1.3.1 The Work shall include the obligation of the Contractor to visit the site of the project before submitting a proposal. Such site visit shall be for the purpose of familiarizing the Contractor with the conditions as they exist and the character of the operations to be carried on under the Contract Documents, including all existing site conditions, access to the site, physical characteristics of the site and surrounding areas.

§ 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. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 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.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

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

§ 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.

§ 1.2.4 Sections of Division 01 – General Requirements govern the execution of the Work of all sections of the specifications

§ 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 retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and 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 the 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 suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, 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 suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

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 may enter into a contract for services with an independent Construction Project Representative for the purpose of reporting to the Owner and the Architect as to the progress of the Work. Such appointment by the Owner shall not relieve the Architect of any of his responsibilities entered into in the Owner-Architect Agreement. In the case of dispute, relative to the quality of materials or work, he shall inform the Architect who shall have authority to reject materials until the questions at issue can be decided by the Architect. The Owner's Construction Project Representative is not authorized to revoke, alter, enlarge, relax or release any requirements of the Contract, nor approve or accept any portion of the work nor issue instructions contrary to such provisions. The Owner's Construction Project Representative shall not act as foreman or perform any duties for the Contractor, nor interfere with the management of the Work by the Contractor. The failure of the Owner's Construction Project Representative to discover or comment upon any work or materials which are not in compliance with the Contract Documents shall not relieve the Contractor or the Architect of their obligations to fully perform the Work in accordance with their respective contracts. The Architect and the Contractor shall be considered to be incidental beneficiaries of the contract between the Owner and its Construction Project Representative

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Paragraph deleted.

§ 2.2.2 Paragraph deleted.

§ 2.2.3 Paragraph deleted.

§ 2.2.4 Paragraph deleted.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 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. Unless otherwise provided under the Contract Documents, the Owner, assisted by the Architect, shall secure and pay for the building permit.

§ 2.3.2 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.

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

§ 2.3.4 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.

§ 2.3.5 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.

§ 2.3.6 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.

§ 2.4 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 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.

§ 2.5 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 ten-day period after receipt of 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 default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for 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. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

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 its 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.

§3.1.4 MUTUAL RESPONSIBILITY OF CONTRACTORS Should the Contractor, in the performance of this Contract, cause or allow to be caused, damage to any persons, property or work of another contractor working on this Project,

they shall upon due notice to do so from the Owner or other party to the damage, arrange for prompt and amicable settlement thereof. It is agreed by all parties herein that such disputes shall not delay completion of the Work, nor be cause for claims against the Owner. Work shall be continued by the party claiming damages at his expense, subject to such damages as may be obtained by due course of law.

§ 3.2 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 2.3.4, 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 submit 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, subject to Section 15.1.7, 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be 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 notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative 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 After the Contract has been executed, the Owner and the Architect consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 01 of the Specifications). By making requests for substitutions, the Contractor:

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

.2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;

.3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects

§ 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.

§3.4.4 The Owner is entitled to deduct from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions.

§ 3.5 Warranty

§ 3.5.1 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.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 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.

§ 3.6.1 The Contractor pays wage and occupation taxes as required by local municipality at project site.

§ 3.6.2 The Contractor must not pay sales or use tax on "building machinery and equipment" (or services to such property) which is transferred to the Owner under this Contract. Remit any tax savings not contemplated in the Contractor's original bid from the Contractor to the Owner as each Application for payment is submitted to the Owner for payment or upon earlier or later identification. In the event that the Owner identifies property that was or could have been purchased exempt from tax by the Contractor for which the Owner has not received a refund, the Owner is authorized to reduce the Final payment by the amount of the sales and use tax savings that was or should have been realized on "building machinery and equipment." Building machinery and equipment are defined as generation equipment, storage equipment, conditioning equipment, distribution equipment, and termination equipment, whether or not: (a) the item constitutes a fixture or is otherwise affixed to the real estate; (b) damage would be done to the item

or its surroundings upon removal; (c) the item is physically located within a real estate structure. The exemption is limited to the following types of machinery and equipment:

.1 air conditioning limited to heating, cooling, purification, humidification, dehumidification, and ventilation;
.2 electrical (not including wire, conduit, receptacle and junction boxes);
.3 plumbing (not including pipes, fittings, pipe supports and hangers);
.4 communications limited to voice, video, data, and sound;
.5 alarms limited to fire, security, and detection;
.6 control systems limited to energy management, traffic, and parking lot and building access;
.7 medical systems limited to diagnosis and treatment, medical gas, nurse call, and doctor paging;
.8 laboratory system;
.9 cathodic protection system;
.10 furniture, cabinetry, and kitchen equipment.

§ 3.6.3 The Contractor checks all materials, equipment, and labor entering into the Work and keeps full and detailed accounts and exercises such controls as may be necessary for proper financial management under this Contract; the accounting and control systems must be satisfactory to the Owner. The Owner and the Owner's Representative must be afforded access to the Contractor's records, books, correspondence, instructions, drawings, receipts, subcontracts, purchase orders, vouchers, memoranda and other data relating to this Contract, and the Contractor preserves these for a period of 3 years after final payment, or for such longer period as may be required by law.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner, assisted by the Architect, shall secure and pay for the building permit. The Contractor shall secure and pay 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 at all times observes, complies with, and posts as required all Federal, State, and local laws, ordinances, and regulations in any manner affecting conduct of work or applying to employees on project, as well as all orders or decrees which have been or may be promulgated or enacted by any legal bodies or tribunals having authority or jurisdiction over work, materials, employees, or contract. Contractor protects and indemnifies Owner and its representatives and Architect and its representatives against any claim or liability arising from or based on violation of any such law, ordinance, regulation, order, or decree, whether by Contractor or its employees.

§ 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 subsurface or otherwise concealed physical conditions that differ materially from those indicated 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 14 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 Paragraphs deleted.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall provide continuous supervision at the project site by a duly authorized and competent superintendent, who shall be acceptable to the Owner, when any work is being performed at the project site by any Prime Contractor or any Subcontractor. At the Owner's request, the Contractor shall assign a different superintendent to the Project. The assignment of a new superintendent shall be without cost to the Owner. The Contractor shall submit to the Owner the name and qualifications of their superintendent at the Initial Job Conference. The Contractor shall not change their superintendent without written approval of the Owner, and must submit to the Owner, in writing, justification for the change, along with the name and qualifications of the individual whom the Contractor proposes to be the new superintendent. The Owner may withhold any payments which are pending or may suspend the work at the Contractor's expense, if the Contractor fails to comply with the provisions of this paragraph.

§ 3.9.2 The Superintendent shall represent the Contractor and all directions and communications given to the Superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

§ 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 and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably 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, or fails to provide submittals in accordance with the approved 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 make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and 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 how 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 the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect 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 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.

§ 3.12.10.1 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 be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately 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 and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and 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.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 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, 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, or patching shall be restored to the condition existing prior to the cutting, fitting, or 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 construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its 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 and 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 the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with 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 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 an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by insurance supplied by either the Owner, the Contractor, or the Subcontractors as required by Article 11 of this Contract, Contractor shall indemnify, defend (at Owner's request and through counsel reasonably acceptable to

Owner), and hold harmless the Owner, the Architect, Architect's consultants, and agents and employees of any of them from and against any and all claims, damages, losses and expenses, including, but not limited to, attorneys' fees and defense costs, 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 in whole or in part by the negligent or wrongful 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 whole or in part by a party indemnified hereunder, even if caused in whole or in part by the Owner. A Contractor or Subcontractor's obligation to defend and/or indemnify the Owner hereunder shall not be limited by the immunity provisions of the Worker's Compensation Act or similar statute. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph 3.18.1. The Owner requires Contractor to execute a Covenant to Indemnify, in form included in Project Manual.

§ 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.

§3.18.3 The Contractor and each Subcontractor, of whatever tier, hereby certifies to the School District that it complies with all employment related laws and regulations governing employment or collective bargaining agreements, if any. Nothing in this Agreement shall be construed as divesting any Contractor or Subcontractor of its sole and exclusive right to control the means, manner or method of performance of the Work of any Contractor or their employees. Nothing in this Agreement shall be construed in a manner that would be violative of the legal or contractual rights of any employee. The Contractor, and each Subcontractor, regardless of tier, shall defend, hold harmless and indemnify the Owner against and from any and all claims, demands, suits, actions, costs and expenses including reasonable attorneys' fees, arising out of or resulting from any claims by an employee or independent contractor of any Contractor or Subcontractor alleging the violation of any of the individuals' employment rights, whether legal, constitutional or contractual in nature even if caused in whole or in part by the acts or omissions of the Owner. This provision shall be accorded the broadest meaning permitted by law.

§3.18.4 The Contractor agrees to indemnify, defend and hold harmless the Owner from and against any and all administrative and judicial actions (including reasonable attorneys' fees related to any such actions) and judgments incurred by the Owner in connection with any labor-related activity arising from the Contractor's performance of the Work. As used in these Contract Documents, "labor-related activity" includes, but is not limited to, strikes, walk-outs, informational or organizations picketing, use of placards, distribution of hand-outs, leaflets or other similar acts at or in the vicinity of the Project or in the vicinity of any other facility where the Owner conducts business. The Owner shall advise the Contractor if any labor-related activity occurs and the Contractor shall arrange for the legal representation necessary to protect the Owner's interest, provided such representation is approved by the Owner in advance.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 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.

§ 4.2 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.

§ 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 promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) 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

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's observations of the work and 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 13.4.2 and 13.4.3, whether or not the 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, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect reviews and takes 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 takes action with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, 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 instruction 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 does not relieve the Contractor of the obligations under Paragraph 3.3, 3.5 and 3.12. The Architect's review does not constitute acceptance of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences, or procedures. The Architect's acceptance of a specific item does not indicate acceptance 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 order 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 Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 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 the 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, within seven (7) days after execution of the Owner-Contractor Agreement, 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.

§ 5.2.1.1 Not later than 10 days after date of commencement, the Contractor must furnish in writing to the Owner through the Architect the names of persons or entities proposed as manufacturers for each of the products specified in the Project Manual and, where applicable, the name of the installing Subcontractor.

§ 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 for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, 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 that the Contractor, by these Contract 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.

§ 5.3.2 The Contractor agrees to include the requirements of Subparagraphs 3.6.2 and 3.6.3, in full, in all contracts with 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; 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 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 with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them.

§ 6.1.3 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has 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 notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work 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. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 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 that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor 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.

§ 6.2.6 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.

§ 6.2.6.1 Should the Contractor, either itself or by its subcontractor or subcontractors or their respective agents, servants, or employees, cause damage or injury to the property or Work of any other Prime Contractor or Contractors, or by failing to perform its Work (including the Work of its subcontractor or subcontractors) with due diligence, delay any Prime Contractor or Contractors, which suffer additional expense or damage as a result the parties involved shall resolve any disputes by agreement or by litigation between said parties. The Owner will not be a party to disputes or actions between Prime Contractors or subcontractors concerning such additional expense or damage. It is agreed by all parties that disputes or actions between Contractors concerning the additional expense or damage will not delay completion of the Work, which shall be continued by the parties, subject to the rights hereinbefore provided. It is agreed by the parties to this Contract (the Owner as promisee and the Contractor as promisor) that the intent of this clause is to benefit the other Prime Contractors on the Project or related Projects and to serve as an indication of the mutual intent to the Owner and the Contractor that this clause raise such other Prime Contractors to the status of third party beneficiaries only as to the terms and conditions of Subparagraph 6.2.3. The Contractor agrees that Subparagraphs 6.2.3 is provided as a benefit to the Contractor and that they specifically exclude claim against the Owner for delay or other damages.

§ 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. The Contractor shall proceed promptly with changes in the Work, 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 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine 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 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
.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, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 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.

§ 7.3.7 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.

§ 7.3.8 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 may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

§ 7.5 Overhead and Profit Rates

§ 7.5.1 For any adjustments to the Contract Sum based on other than the unit price method, overhead and profit combined shall be calculated at the following percentage of the cost attributable to the Change in the Work:

.1 For work performed by the Contractor with its own forces, 15 percent of the cost.

.2 For work performed by the Contractor's Subcontractor, 5 percent of the amount due the Subcontractor.

.3 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraphs 7.3.4.1 through 7.3.4.5

.4 When both additions and credits are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase, if any. Overhead and profit shall be reduced-accordingly when the net change results in a credit.

.5 To facilitate checking of quotations for extras or credits, all proposals shall be accompanied by a complete itemization of costs including labor, material, fees, overhead and profit, and subcontracts. When major cost items are Subcontracts, they shall be likewise itemized.

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, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 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. Temporary delays in the work due to seasonal inclement weather shall not be considered as sufficient cause for extension of time. Where the delay arises from acts, omissions, or defaults of another Prime Contractor or the other Prime's subcontractors and suppliers, then the Contractor will be entitled to no extension of time and their sole remedy will be a proceeding pursuant to Article 15 of these General Conditions.

§8.3.1.1 No such Change Order extending the Contract time shall result in any increased payments to the Contractor for overhead, extended overhead, or for any other amounts of any nature.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15. Request for extension of Contract Completion Date shall be submitted in writing to the Architect not more than seven (7) days after the commencement of the delay; otherwise, it shall be waived. This request shall contain at a minimum the following information: (1) date of start of delay; (2) specific cause of delay; (3) effect of delay on construction progress; (4) date of termination of delay; (5) statement of bonded surety concurring in request for extension of Contract Completion Date and the Agreement to extend coverages for the requested extension; (6) evidence of notification of this request having been given to the Owner and Architect; (7) evidence of notification of this request having been given to all Contractors engaged on the project and their concurrence to such extension of time.

§ 8.3.3 The Architect and Owner will not be liable to any Contractor or any subcontractors engaged on this project in any manner for any expenses, damages, loss of profits, anticipated or otherwise, or any other charges whatsoever arising out of an extension in the Completion Date for the work of either the Contractor or of any subcontractor engaged on this project, or arising out of any hindrance or delay from any cause whatsoever in the progress of the work, whether such hindrance or delay be avoidable or unavoidable.

§8.3.4 The Contractors are required to submit at any construction conference considering any claim and at any proceeding considering an extension of time and in all subsequent administrative proceedings, all files, records, and the documents of whatever kind pertaining to the Contractor's performance of the Project Work , the job budget, the summary of all supporting data worksheets and other materials related to the estimate, material and labor scheduling details, and other documents prepared in connection with the submittal of the Contractor's successful bid.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 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.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

§ 9.3.1 At least fifteen 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. The form of Application for Payment is a notarized AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet.

§ 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 supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 Until the Work is 51 percent completed, the Owner pays 90 percent of the amount due the Contractor on account of progress payments. When the work is 50 percent completed, 1/2 of the amount retained by the Owner is returned to the Contractor provided that the Architect approves the application for payment and the Contractor is making satisfactory progress and there is no specific cause for greater withholding. Thereafter the Owner pays 95 percent of the amount due the Contractor on account of progress payments. If the manner of completion of the Work and its progress are not satisfactory to the Architect, or if any other good and sufficient reason arises, the amount retained by the Owner may be increased up to 1-1/2 times the amount of any possible payments. If a dispute arises between Owner and Contractor based upon increased costs claimed by Contractor occasioned by delays or other actions of any Contractor, additional retainage in the sum of one and one-half times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the Contractor causing the additional claim furnishes a bond satisfactory to Owner to indemnify Owner against the claim.

§ 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, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.3.4 The Contractor for itself and for its Subcontractors, laborers and material suppliers and all other directly or indirectly acting for, through or under it or any of them covenants and agrees that no mechanic's liens or claims will be filed or maintained against the Project, the Premises, or any part thereof, or any interest therein or any improvements thereon, or the Owner or against any monies due or to become due from the Owner to the Contractor, for or on account of any work, labor, services, materials, equipment and other items provided under any Change Order or supplemental agreement for extra or additional work in connection with the Project as to the original work covered by the Contract Documents. This Project is purely for a public purpose and as such, mechanics' lien are expressly prohibited under the PA Mechanics' Lien Law, 49 Pa. C.S.A**.** §1303, *et. seq.* If any Subcontractor, laborer or material supplier of the Contractor or any other person directly or indirectly acting for, through or under it or any of them files or maintains a mechanic's lien or claim as aforesaid, the Contractor agrees to cause such liens and claims be satisfied, removed or discharged at its own expense by bond, payment or otherwise within ten (10) days from the date of the filing thereof, and upon its failure to do so, the Owner shall have the right, in addition to all other rights and remedies provided under the Contract Documents or by law, to cause such liens or claims to be satisfied, removed or discharged by whatever means the Owner chooses, at the entire cost and expense of the Contractor (such cost and expense to include reasonable attorney's fees and disbursements). The Contractor agrees to indemnify, defend, save and hold harmless the Owner from and against any and all such liens and claims and actions brought or judgments rendered thereon, and from and against any and all loss damages, liability, costs and expenses, including reasonable attorney's fees and disbursements, which the Owner may sustain or incur in connection therewith.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole 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 in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. 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. 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 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 suppliers 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 unsatisfactory prosecution of the Work in accordance with the Contract Documents; or
.8 failure to meet scheduled benchmarks throughout the Project period.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

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

§ 9.5.4 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. No such issuance of joint checks will cause a contract to be created between Owner and any Subcontractor.

§ 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. Such payment by the Owner shall not constitute approval or acceptance of any item or cost in the Application for payment. No partial payment made hereunder shall be or be construed to be final acceptance or approval of that portion of the work to which such partial payment relates or relieves the Contractor of any of its obligations hereunder with respect thereto.

§ 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 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 and suppliers 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 or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to 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 or provided by 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, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 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' 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 shutdown, 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.

§ 9.8.1.1 The Contractor shall achieve Substantial Completion of the entire Work per AIA Document A101, Article 3.3

§ 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; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and 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 the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the 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. The

payment will be sufficient to increase the total payments to 95 percent of the Contract Sum, less such amounts as the Architect determines for incomplete Work and unsettled claims.

§ 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 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.

§ 9.9.4 As portions of the Project are completed, and occupied, Contractor shall ensure the continuing construction activity will not unreasonably interfere with the use, occupancy and quiet enjoyment of the completed portions thereof.

§ 9.9.5 The Contractor agrees to coordinate the Work with the Architect and the Owner in order to minimize disturbance to occupied portions of the structure. In the event performances or tests are conducted in close proximity to the Work in progress, the Contractor agrees to cease all work which may disturb the Owner's occupants at the site.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's 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. 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 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), 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.

§ 9.10.2.1 The final payment including the retainage, becomes due in 60 days following the Date of Substantial Completion and receipt of the Final Application for Payment, provided that the Contractor has submitted all

documents as required in this Subparagraph 9.10.2 and elsewhere in the Project Manual. The final payment may be reduced by an amount, as certified by the Architect, to equal 1-1/2 times the cost required to complete any remaining incomplete items. Final payment of any amount so withheld will be paid forthwith upon completion of these items.

§ 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, corrected, 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 the 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 a 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.

§9.11 Liquidated Damages
§9.11.1 None.

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, including special safety precautions and programs for the protection of staff, students, visitors, and others who use the premises.

§ 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, the public, the Owner and its officers, directors and employees, students, visitors, 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, a Subcontractor, or a Sub-subcontractor; 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.
.4 construction or operations by the Owner, Separate Contractors, or other Contractors.

§ 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 implement, 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 the owners and users of adjacent sites and utilities of the safeguards.

§ 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 and in strict compliance with all applicable requirements of law and governmental regulations.

§ 10.2.4.1 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary, the Contractor gives the Owner reasonable advance notice.

§ 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. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is 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, notice of the 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 and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. 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 notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's 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 the material or substance or who are to perform the task of removal or safe containment of the 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 by the amount of the Contractor's reasonable additional costs of shutdown, 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 hazardous 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 hazardous 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 reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances 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 reimburse 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 Insurance and Bonds

§ 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 including private entities performing Work at the site and exempt from the coverage on account of number of employees or occupation, which entities must maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the Project;

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees or persons or entitites excluded by statute from the requirements of Clause 11.1.1.1 but required by the Contract Documents to provide the insurance required by the Clause;

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

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

.5 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;

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

.7 Claims involving blanket oral and written contractual liability insurance applicable to the Contractor's obligations under Section 3.18

§ 11.1.1.8 Liability insurance includes all major divisions of coverage and is on a comprehensive basis including:

1. Premises-Operations (including X. C and U coverages as applicable).
2. Independent Contractors' Protective.
3. Products-Completed Operations.

4. Personal Injury Liability with Contractual Liability Exclusion deleted.
5. Contractual Liability, including specified provision for Contractor's obligation under paragraph 3.18.
6. Owned, Non-Owned, and Hired Motor Vehicles.
7. Broad Form Property Damage including Completed Operations.

§11.1.1.9 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date must predate the Contract, the termination date of the policy or applicable extended reporting period must be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2

§ 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.

§ 11.1.2.1 Provide the required insurance by a company or companies licensed to do business in the Commonwealth of Pennsylvania, which have a minimum Best rating of "A-" and a minimum policy holder's surplus of $100 million and against which the Owner has no reasonable objection.

§ 11.1.2.2 Write the insurance required by Subparagraph 11.1.1 for not less than the following limits, or greater if required by law:

1. Workers' Compensation and Employer's liability.
   (a) State: Statutory.
   (b) Applicable Federal (e.g., Longshoremen's): Statutory.
   (c) $ 500,000 each accident.
   (d) $ 500,000 disease policy limit.
   (e) $ 500,000 disease each employee

2. Commercial General Liability (Occurrence) including Owner's and Contractor's Protective.
   (a) $ 3,000,000 general aggregate.
   (b) $ 3,000,000 products/completed operations aggregate.
   (c) $ 1,000,000 personal and advertising injury.
   (d) $ 1,000,000 each occurrence.
   (e) $ 50,000 fire damage, any one fire.
   (f) $ 5,000 medical expense, any one person.

3. Business Auto Liability.
   (a) Any vehicle, hired vehicles, and non-owned vehicles.
   (b) $ 1,000,000 combined single limit.

4. Excess or Umbrella Liability.
   (a) $ 1,000,000 each occurrence.
   (b) $ 3,000,000 aggregate.
   (c) $ 10,000 retention for self-insured hazards, each occurrence.

5. Provide a "Project Aggregate" CG 25 03 endorsement for all insurance policies.

§ 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. If this insurance is written on the Comprehensive General Liability policy form, the Certificates must be AIA Document G705, Certificate of Insurance. If this insurance is written on a Commercial General Liability policy form, ACORD form 25S is acceptable. Furnish 2 copies of Certificates herein required; furnish 2 copies of any endorsements that are subsequently issued amending coverages or limits; and furnish 2 copies of Certificates at time of policy renewal indicating such renewal. The Certificates must set forth evidence of all coverages required by the Contract Documents, and must specifically certify the following:

1. The coverage afforded under these policies will not be cancelled, non-renewed materially changed, with the limits reduced without a minimum of 60 days prior written notice, by certified mail, being given to the Owner (the certificate holder named in the lower left hand corner of ACORD Form 25S).
2. The Owner, the Architect, and the Architect's Consultants are named as additional insureds for all required coverages except workers' compensation, in and as their interests appear.

§ 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

§ 11.2.1 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. The form of policy for this coverage must be Completed Value.

§ 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 This Property Insurance shall be written with no 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.

§ 11.3.1.6 The insurance required by paragraph 11.3 is not intended to cover machinery, tools or equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor must, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment which are subject to the provisions of Subparagraph 11.3.7

§ 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 If the Contractor so requests, 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.

§ 11.3.9 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 litigation in the Court of Common Pleas of Washington County, PA, as set forth 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 by litigation in the Court of Common Pleas of Washington County, PA, the method selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 Contractors shall furnish to the Architect, for the benefit of the Owner, a Performance Bond as security for the faithful performance of the Contract. Contractors shall furnish to the Architect, for the benefit of the Owner, a separate Labor and Materials Payment Bond as security for the payment of all persons performing labor and furnishing materials in connection with this Contract. The Performance and Payment bonds shall be in an amount at least equal to the 100 percent of the Contract Sum. Bonds shall be written on AIA Document A312 in a form required by the Contract Documents and satisfactory to the Owner and other designated beneficiaries. The Bonds shall be written by a surety company approved by the Owner and Architect and licensed to do business in the Commonwealth of Pennsylvania and otherwise comply with the requirements of Applicable Laws. All Bonds signed by an agent must be accompanied by a certified copy of the authority for the agent to act. The Bonds shall remain fully in effect for a period commencing prior to the commencement of Contractor's Work and ending 1 year after Final Completion.

§ 11.4.1.1 Provide the required bonds by a company or companies licensed to do business in the Commonwealth of Pennsylvania, which have a minimum Best rating of "A-," a minimum policy holder's surplus of $100 million, are listed on the current U.S. Treasury Circular No. 570 (sureties acceptable for federally financed construction projects), and against which the Owner has no reasonable objection.

§ 11.4.1.2 The Contractor must deliver the required bonds to the Owner before the Agreement is entered into.

§ 11.4.1.3 The Contractor requires the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

§ 11.4.1.4 The performance bond, in the event of a default of the Contractor, obligates the surety to take over and complete the Work up to the penal sum of the bond. The performance bond provided must not allow for the surety to pay over funds to the Owner to complete the Project nor allow the surety to tender a replacement Contractor.

§ 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.

§ 11.4.3 If the surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or if its right to do business in the Commonwealth is terminated or if it ceases to meet the requirements set forth in Subparagraph 11.4.1, Contractor shall promptly (without additional cost to the Owner), but in all events within five (5) days after the occurrence of any such event, substitute another Bond and Surety in compliance with the requirements of this Paragraph.

§11.5 Insurance Carriers

§ 11.5.1 If any party is damaged by the failure of the other to purchase or maintain insurance required under Article 11 and so notifies the other party, then the party who failed to purchase or maintain the insurance shall bear all reasonable costs properly attributable thereto.

§ 11.5.2 Whenever the Contractor is required under these Contract Documents to furnish insurance coverage, all policies of insurance so furnished shall be issued by an insurance company or by insurance companies qualified to do business in the Commonwealth of Pennsylvania.

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, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before 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 any 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 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 2.5.

§ 12.2.2.2 In the event the Contractor corrects any deficiency or furnishes any new equipment or material as a consequence of a breach of any special warranty or if any of the Work is found to be defective, a new 1 year period of warranty commences with the completion of the correction of the defective Work of the replacement of the defective equipment or material.

§ 12.2.2.3 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.

§ 12.2.2.4 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 of the Owner or Separate Contractors, whether completed or partially completed, 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.

§ 12.2.6 The obligations under this Section 12.2 shall cover any repairs and replacement to any part of the Work or other property caused by the defective 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 Commonwealth of Pennsylvania, Washington County.

§ 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 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 the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 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.

§ 13.3.2 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 upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 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.

§ 13.4.2 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 13.4.1, 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 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 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.

§ 13.4.4 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.

§ 13.4.5 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.

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

§ 13.5 Interest

The final payment due the Contractor from the Owner bears interest at a rate of 6 percent per annum for all Contracts with provisions for retainage, such interest to begin after the date that such payment becomes due and payable to the Contractor; provided, however, that where the contracting body has issued bonds to finance the project, interest is payable to the Contractor at the rate of interest of the bond issue or 6 percent per annum, whichever is less.

§ 13.6 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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may suspend the Work 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; or

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

§ 14.1.2 The Contractor may upon fourteen (14) days written notice and an opportunity to cure, provide notice to the Owner of its intent to 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, after fourteen (14) days written notice and an opportunity to cure, the Contractor may, upon seven additional days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, and costs and expenses actually incurred.

§ 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, suspend performance under the Contract and, when work resumes, 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 refuses or fails to supply enough properly skilled workers or proper materials;

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

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

.4 otherwise is in breach of a provision of the Contract Documents.

.5 fails to abide by the Project Construction Schedule, and/or fails, within seven days after receipt of written notice to correct or recover the schedule, to provide required scheduling information;

.6 institutes proceedings or consents to proceedings requesting relief under the Federal Bankruptcy Code or if a Petition under the Federal Bankruptcy Code is filed against the Contractor and such Petition is not dismissed within sixty (60) days from the date of said filing; or

.7 abandons the work.

§ 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, three 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, commencing upon the thirty-first (31st) day of such suspension, delay or interruption. Adjustment of the Contract Sum shall include compensation for actual expenses incurred as a result of the suspension, delay or interruption. 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 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 all accepted and/or approved work and expenses actually earned and incurred .

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, a change in the Contract Time, 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. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.1.1 In the event of unresolved disputes which proceed to litigation, claims shall be litigated in the Court of Common Pleas of Washington, Pennsylvania.

§ 15.1.2 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 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by 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 under this Section 15.1.3.1 shall 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.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 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.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 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.

§ 15.1.6.2 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.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor waives claims against the Owner for consequential damages arising out of or relating to this Contract. This waiver includes 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 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 15.1.7 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.1.7.1 Disputes or Actions Between Contractors

Should the Contractor either itself or by its subcontractor or subcontractors of its agents, servants, or employees, cause damage or injury to the property or Work of any other Prime Contractor or Contractors, or by performing or failing to perform his Work including the Work of his subcontractor or subcontractors hereunder with due diligency, delay or interfere with any Prime Contractor or Contractors who shall suffer additional expense or damage thereby, the parties involved in such dispute shall settle by agreement or litigate said claim, dispute, or disputes in the Court of Common Pleas of Washington County, Pennsylvania.

§ 15.1.7.2 The Owner shall not be a party to disputes or actions between Prime Contractors or subcontractors concerning such additional expense or damage. It is agreed by all parties that disputes or actions between Contractors concerning the additional expense or damage hereinbefore mentioned shall not delay completion of the Work which shall be continued by the parties, subject to the rights hereinbefore provided.

§ 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.

§ 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 the 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 litigation in the Court of Common Pleas of Washington County, Pennsylvania.

§ 15.2.6 Either party may file for mediation of an initial decision at any time and must file for mediation as a condition precedent to litigation in the Court of Common Pleas of Washington County, Pennsylvania.

§ 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.

§ 15.3 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 15.1.7, shall be subject to mediation as a condition precedent to litigation in the Court of Common Pleas of Washington County, Pennsylvania.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by a third party private mediator agreeable to all parties. 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 litigation but, in such event, mediation shall proceed in advance of litigation, 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.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in Washington County, Pennsylvania, 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 Clearances

§ 15.4.1 All Contractors and Subcontractors on this Project must have clearances related to: Child Abuse History Act 33/151; Pennsylvania State Police Act 34; Fingerprinting; a Clearance Affidavit; and Federal Criminal History Record Act 114 Clearance and must present them to the Owner's representative on or prior to the time as directed by the Owner. A badge attesting to those Clearances should be carried by each individual workman when on the premises or in the buildings. The cost of obtaining these "clearances" and required badges shall be the responsibility of the Contractor.

§ 15.4.2 Public Works Employment Verification Act: All Contractors and Subcontractors of whatever tier are required to comply with the Public Works Employment Verification Act, 43 P.S. §§167.1-167.11 and its Chapter 66 implementing guidelines. All Contractors and Subcontractors performing work on this Project are required to comply with Federal Employment Eligibility Requirements through the United States Department of Homeland Security's E-Verify Program. For each employee hired on or after January 1, 2013, Contractors and subcontractors must submit a Public Works Employment Verification Form to the School District prior to being awarded a Public Works Contract and throughout the duration of the Project, regardless of whether such employees will work onsite or offsite. Contractors and subcontractors shall update the Verification Forms throughout the duration of the Project. Contractors shall include the requirement to comply with this Act in each and every subcontract into which they enter on this Project. The School District will maintain the Form for the duration of the Project. The Form may be accessed at: www.dgs.state.pa.us. The Chapter 66 implementing guidelines are located at http://www.pabulletin.com/secure/data/vol42/42-52/index.html.

§15.5 Prevailing Wage Rates:

If the total estimated project sum is greater than $25,000.00, this regulation and the general Pennsylvania prevailing minimum wage rates, (Act 442 of 1961, P.L. 987, amended) as determined by the Secretary of Labor and Industry, which shall be paid for each craft or classification of all workers needed to perform the contract during the anticipated term therefore in the locality in which public work is performed, are made part of this Contract.

§ 15.5.1 No workmen shall be employed on this work except in accord with the classifications set forth in the decision of the Secretary of Labor and Industry. If additional or different classifications are necessary, the procedure set forth in Section 7 of the Regulations for Pennsylvania Prevailing Wage Act shall be followed.

§ 15.5.2 All workmen employed or working on this work shall be paid unconditionally, regardless of whether any contractual relationship exists or the nature of any contractual relationship which may be alleged indirectly, except authorized deductions, the full amounts due at the time worked in the appropriate classification. This Contract does not prohibit payment of more than the general prevailing minimum wage rates as determined by the Secretary of Labor and Industry.

§ 15.5.3 Each Contractor and Subcontractor shall post for the entire period of construction the wage determination decisions of the Secretary of Labor and Industry, including the effective date of any changes thereof, in a prominent and easily accessible place or places at the site of the work and at such place or places used by them to pay workmen their wages. Subcontractors need not post such decisions in the same places where they are posted by Contractors. The posted notice of wage rates shall contain the following information:

.1 Name of Project.

.2 Name of Public Body for which it is being constructed.

.3 The crafts and classifications of workmen listed in the Secretary's general prevailing minimum wage rate determination for the particular project.

.4 The general prevailing minimum wage rates determined for each craft and classification and the effective date of any changes.

.5 A statement advising workmen that if they have been paid less than the general prevailing minimum wage for their job classification, or if the Contractor or Subcontractor or both are not complying with the Act or the Regulations in any manner whatsoever, they may file a protest, in writing, with the Secretary of Labor and Industry within three months of the date of the occurrence, objecting to the payment of any Contractor or Subcontractor to the extent of the amount or amounts due or to become due to them as wages for work performed on the public work project. Any workmen paid less than the rate specified in the Contract shall have a civil right of action for the difference between the wage paid and the wages stipulated in the Contract, which right of action shall be exercised within six months from the occurrence of the event creating such right.

§ 15.5.4 The Contractor and each Subcontractor shall keep accurate records showing the name, craft, classification, number of hours worked per day and actual hourly rate of wage paid (including employee benefits) to each workman employed by him in connection with work. Such record shall include any deductions from each workman. The record shall be preserved for three years from the date of payment and shall be open at all reasonable hours to the inspection of the public body awarding the Contract and to the Secretary of Labor and Industry or his duly authorized representatives.

§ 15.5.5 Apprentices shall be limited to such numbers as shall be in accord with a bonafide apprenticeship program registered with and approved by the Pennsylvania Apprenticeship and Training Council and only apprentices whose training and employment are in full compliance with the provisions of the Apprenticeship and Training Act approved July 14, 1961 (Act No. 304) and the Rules and Regulations issued pursuant thereto shall be employed on the public work project. Any workman using the tools of a craft who does not qualify as an apprentice within the provisions of this Section shall be paid the rate predetermined for journeymen in that particular craft and classification.

.1 Wages shall be paid without any deductions except authorized deductions. Employers not parties to a contract requiring contributions for employee benefits which the Secretary has determined to be included in the general prevailing minimum wage rate shall pay the monetary equivalent thereof directly to the workmen.

.2 Payment of compensation to workmen for work performed on public work on a lump sum basis, or a piece work system, or a price certain for the completion of a certain amount of work, or the production of a certain

result shall be deemed a violation of the Act and these Regulations, regardless of the average hourly earning resulting therefrom.

.3 Each Contractor and each Subcontractor shall file a statement each week and a final statement at the conclusion of the Work on the contract with the contracting agency, under oath, and in form satisfactory to the Secretary, certifying that all workmen have been paid wages in strict conformity with the provisions of the contract as prescribed by this Section 3 of these Regulations, or if any wages remain unpaid to set forth the amount of wages due and owing to each workman respectively

§15.6 DISCRIMINATION PROHIBITED:
According to 62 Pa.C.S.A. § 3701, the Contractor agrees:

(1) In the hiring of employees for the performance of Work under the contract or any subcontract, no contractor, subcontractor, or any person acting on behalf of the contractor or subcontractor shall by reason of gender, race, creed, or color, discriminate against any citizen of this Commonwealth who is qualified and available to perform the Work to which the employment relates;
(2) no Contractor, Subcontractor, Sub-Subcontractor or any person on their behalf shall in any manner discriminate against or intimidate any employee hired for the performance of Work under the contract on account of gender, race, creed, or color;
(3) The contract may be canceled or terminated by the government agency, and all money due or to become due under the contract may be forfeited for a violation of the terms or conditions of that portion of the contract.

(4) Contractors are bound by Appendix F to Exhibit A to the parties' Agreement, in its entirety as it relates to the Contractor's work on the Project.

§15.7 Human Relations Act:
The provisions of the Pennsylvania Human Relations Act, Act 222, of October 27, 1955 (P.L. 744) (43 P.S. Section 951, et. seq.) of the Commonwealth of Pennsylvania prohibit discrimination because of race, color, religious creed, ancestry, age, sex, national origin, handicap or disability, by employers, employment agencies, labor organizations, contractors and others. The Contractor shall agree to comply with the provisions of this Act as amended that is made part of this specification. Your attention is directed to the language of the Commonwealths' non-discrimination clause in 16 PA. Code 49.101.

§16.1 Equal Employment Opportunity.
§16.1.1: The Contractor shall maintain policies of employment as follows:

§16.1.1.1: The Contractor, Contractor's Subcontractors and Sub-Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; lay-off or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

§16.1.1.2: The Contractor, Contractor's Subcontractors and Sub-Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: 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 either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into 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 indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if 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 the Contract.

D. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES (Electrical Construction)

A. **ALTERNATE E-1 – NEW BRANCH CIRCUIT WIRING**

1. **Base Bid:** At all existing to remain electrical receptacles remove existing receptacle, and replace with new GFCI receptacle in existing backbox; connect new device to existing branch circuit wiring and provide new faceplate.
2. **Alternate Bid E-1 – NEW BRANCH CIRCUIT WIRING**: Replace all existing to remain electrical receptacles as per the base bid and provide new branch circuit wiring in existing conduit.

B. ALTERNATE E-2 NEW PANELBOARD INTERIORS

1. **Base Bid:** Existing panelboards to remain.
2. **Alternate Bid E-2 – NEW PANELBOARD INTERIORS:** Remove existing panelboard interiors and portion of feeder and replace with new. Applies to three panelboards.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions after award of Contract.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

    a. Substitutions for Convenience will not be considered under this Contract without a corresponding reduction in Contract Sum or Contract Time.

1.3 ACTION SUBMITTALS

A. Substitution Requests:

1. Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
2. Substitution Request Form: Use form provided by or otherwise acceptable to Architect.
3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation method cannot be provided, or relative advantages of proposed substitution with regard to quality, performance, cost or project scheduling.
    b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

        1) Evaluation criteria may also include reference standards, warranty, operation, finishes, manufacturer's or supplier's history and capability, history and competence of product representatives, installer availability, history and competence.

    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if requested, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

4. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

B. Contractor may submit a request for substitution (other than for cause) only as part of a Change Order request to reduce the Contract Sum, or Contract Time, or both.

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.

e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. Requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial net advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume in accepting the substitution. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents, in the judgment of the Architect or its consultants.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor’s construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. Requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 01 2926– MODIFICATION AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements necessary to prepare and process Contract Modifications and Applications for Payment.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Prepare and submit Schedule of Values using AIA G703 form.
2. Correlate line items in the Schedule of Values with Application for Payment forms and construction schedule.
3. Correlate line items in Schedule of Values with Construction Phases and major portions of the Project, as appropriate.
4. Separate the line item values for Labor and Materials.
5. Submit the Schedule of Values at earliest possible date but no later than 30 days before the date scheduled for submittal of initial Applications for Payment.
6. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

   a. Project name and location.
   b. Owner's Project number.
   c. Name of Architect
   d. Architect's Project number.
   e. Contractor's name and address.
   f. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703. or other equivalent form approved by Architect at the initial Job Conference.

3. Show a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Show Labor and Materials as separate line items. Coordinate with the Project Manual table of contents. Show several line items for principal subcontract amounts, in excess of five percent of the Contract Sum, or where otherwise appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Show a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

        1) Include evidence of insurance or bonded warehousing, a copy of the invoice for said materials, the location of materials, and a photograph of the materials showing the materials clearly labeled for this Project.

6. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and, except as otherwise indicated, proportionate share of general overhead and profit for each item.
7. In addition to detail described above, show separate line items to indicate values, subject to approval by Architect, for the following activities and overhead items:

    a. Schedule
    b. Schedule Sign-off
    c. Monthly Schedule updates
    d. Submittals Schedule
    e. Bonds
    f. Insurance premiums
    g. Temporary facilities
    h. Temporary utilities
    i. Coordination drawings
    j. Project Closeout:

        1) Record drawings
        2) Final cleaning
        3) Demobilization
        4) Close out documents - O & M and warranties
        5) Trailer staging and parking area restoration

C. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on form provided as part of web-based Project management software. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.7 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form provided as part of web-based Project management software.

1.8 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1. Change Order contains a description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

1.9 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Period: The period for each progress payment is approximately thirty days in length. The period shall start on the same day each month and end on the same day of the following month, as indicated in the Agreement, with the period ranging from 28 days through 31 days.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment and Schedule of Values form specified herein.

D. Application Preparation: Complete every entry on form. Submittal deadline for timely processing is indicated in the Agreement. At least seven calendar days prior to indicated deadline for submittal of Application, submit a pencil copy to the Architect for preliminary approval. Upon receipt of approved pencil copy, prepare ink copy notarized and executed by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.

c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit four signed original copies of each Application for Payment to Architect by a method ensuring receipt on or before the day indicated in the Agreement. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Schedule of unit prices.
6. Action Submittals schedule (preliminary if not final):

a. Schedule of Shop Drawing Submittals.
b. Schedule of Data Submittals.
c. Schedule of Sample Submittals.

7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies (unless submitted before executing Contract).
14. Performance and payment bonds (unless submitted before executing Contract).
15. Data needed to acquire Owner's insurance (unless submitted before executing Contract).

H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 7700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

6. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
7. AIA Document G707 “Consent of Surety to Final Payment.”
8. Evidence that claims have been settled.
9. Operation and Maintenance Manuals.
10. Warranties.
11. Accepted schedule for demonstration and training.
12. Proof that taxes, fees, and similar obligations are paid.
13. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2926

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Requests for Information (RFIs).
3. Project meetings.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Each contractor coordinates its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

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

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance of and accessibility to required components, including but not limited to mechanical, electrical, plumbing, communication, fire protection.

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

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

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

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Checking, Startup, testing and adjustment of components and systems.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form provided by Architect at the Preconstruction Conference.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be rejected with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name and Architect's Project Number.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI forms and protocols have been established for the Project. Verify standards and procedures with Architect prior to beginning work.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow ten working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 working days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at each progress meeting. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Architect will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting records significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting. Distribution will by electronic mail, US mail, or facsimile machine as agreed upon by participants.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a mutually agreed upon time between Owner, Architect and Contractor.

1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference must be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Commissioning requirements
    m. Preparation of record documents.
    n. Use of the premises and existing building.
    o. Work restrictions.
    p. Working hours.
    q. Owner's occupancy requirements.
    r. Responsibility for temporary facilities and controls.
    s. Procedures for moisture and mold control.
    t. Procedures for disruptions and shutdowns.
    u. Construction waste management and recycling.
    v. Parking availability.
    w. Office, work, and storage areas.
    x. Equipment deliveries and priorities.
    y. First aid.
    z. Security.
    aa. Progress cleaning.

4. Minutes: Architect will record and distribute meeting minutes.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility requirements.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written instructions.

n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Commissioning requirements
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Contractor shall distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Architect conducts progress meetings at regular intervals.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities must be represented at these meetings. All participants at the meeting must be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Discuss how to maintain planned progress of the work and construction behind schedule per requirements of the Division 01 Supplementary Conditions; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.

1) Review schedule for next period.

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

1) Interface requirements.
2) Sequence of operations.
3) Status of Submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.

17) Pending claims and disputes.
18) Documentation of commissioning related requirements.
19) Documentation of information for payment requests.

3. Minutes: The Architect will record and distribute the meeting minutes to each Contractor and to parties requiring information.

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

E. Coordination Meetings: Contractor will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities must be represented at these meetings. All participants at the meetings must be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Discuss how to maintain planned progress of the work and construction behind schedule per requirements of the Division 01 Supplementary Conditions; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Commissioning requirements
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Change Orders.

3. Reporting: Contractor to record meeting results and distribute copies to each Contractor, the Owner and the Architect and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. All provisions, requirements and work indicated or implied by other documents of this Project are interrelated with the requirements contained herein.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Material location reports.
5. Site condition reports.
6. Special reports.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.

B. Startup construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. Construction Schedule Updating Reports: Submit with Applications for Payment and at progress meetings.

E. Material Location Reports: Submit with Applications for Payment.

F. Site Condition Reports: Submit at time of discovery of differing conditions.

G. Special Reports: Submit at time of unusual event.

1.4 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.

3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to the date of Substantial Completion and final completion.

1. Contract completion date is not changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat work area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 10 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 30 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work under More Than One Contract: Include a separate activity for each contract.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Use of premises restrictions.
e. Seasonal variations.
f. Environmental control.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, Notice to Proceed, Substantial Completion, and final completion and the following:

1. Last day of school;
2. Staff's return at the end of summer.
3. First day of student's return to school.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 30 days of construction. Include skeleton diagram for the remainder of the Work.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 REPORTS

A. Material Location Reports: With each Application for Payment, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at the regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 3200

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Contractor shall submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Submit submittal schedule within 30 days of Award of Contract.
2. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
3. Initial Submittal Schedule: Submit within 14 days of Notice to Proceed. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
4. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

5. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.

i. Scheduled dates for installation.
j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Submitting Contractor's approval stamp.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier.

    a. Observe VEBH standards. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.

9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as required by Architect.

    a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Indicate revision number as a suffix to unique submittal number.
4. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts, technical data sheets, product specifications.

b. Standard color charts.
c. Statement of compliance with specified referenced standards.
d. Testing by recognized testing agency.
e. Application of testing agency labels and seals.
f. Notation of coordination requirements.
g. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample set; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.

6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files may be provided to Contractor, for Contractor's use in connection with Project shop drawings, subject to the conditions on the request form.

1. Obtain request form from Architect and complete the information requested on the form.

1.8 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable, making appropriate reference to specification Section Number, Article and Paragraph.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Manufacturer’s color charts, as required by Contract Documents
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Standard product operating and maintenance manuals.
h. Compliance with recognized trade association standards.
i. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of drawings adapted from Architect's CAD/BIM Drawings are otherwise permitted.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Roughing-in and setting diagrams.
d. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
e. Compliance with specified standards.
f. Notation of coordination requirements.
g. Relationship to adjoining construction clearly indicated.
h. Seal and signature of professional engineer, if specified.
i. Notation of coordination requirements.
j. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

D. Coordination Drawings: Comply with requirements in Division 01 Section "Project Management and Coordination."

E. Samples: Prepare physical units of materials or products, including the following:

1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

2. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
   b. Submit a single sample where assembly characteristics, workmanship, fabrication techniques, connections, or operations are to be demonstrated. Sample will be retained by Architect.

3. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

   a. Generic description of Sample.
   b. Product name or name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

G. Delegated-Design Submittal: Comply with requirements in Division 01 Section "Quality Requirements."

H. Application for Payment: Comply with requirements in Division 01 Section "Modification and Payment Procedures."

I. Schedule of Values: Comply with requirements in Division 01 Section "Modification and Payment Procedures."

J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit electronically, as with Action Submittals, except that Architect will log and acknowledge receipt but is not obligated to return processed Informational Submittal.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements in Division 01 Section "Quality Requirements."

B. Contractors Combined Construction Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

L. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations.

1. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

M. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 01 Section “Operation and Maintenance Data.”

N. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

O. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement as to whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

P. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

Q. Construction Photographs and/or Video recordings: Comply with requirements in Division 01 Section Selective Demolition.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect and Architect’s consultants will not review submittals received from Contractor that do not have Contractor's review and approval.

3.2 ARCHITECT'S AND REVIEW

A. Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

F. Submittals received from sources other than Contractor will be returned by Architect without action.

G. Submittals not required by the Contract Documents will be returned by Architect without action.

END OF SECTION 01 3300

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction.

1. Mockups are constructed to:

a. Verify selections made under Sample submittals
b. Demonstrate aesthetic effects and qualities of materials and execution
c. Review coordination, testing, or operation
d. Show interface between dissimilar materials
e. Demonstrate compliance with specified installation tolerances.

2. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

3. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.

    a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.
    b. Where directed, sequence construction of mockup to allow for interim viewing and acceptance of stages of the Work.

4. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
5. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or

quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems comply with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

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

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures,

controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

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

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

E. Professional Engineer Qualifications: A professional engineer who is licensed to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing, when required: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. When required, build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
5. When required, build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
6. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
7. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

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

1. Build mockups of size indicated. Refer to ‘Mockup Notes’ on Drawings.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups, as required: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.

1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

    a. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
7. Special tests and inspections performed by the Owner shall not negate the Contractor’s responsibility for Contractor’s testing and reporting.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

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

1. Notify Architect, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements, or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."

1. Manufacturer's authorized representative shall attend applicable pre-installation conferences and at intervals necessary to ensure components are installed according to the Manufacturer's standards and according to the Manufacturer's instructions.

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

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

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies, unless testing agency is contracted to pick up samples from site.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

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

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

I. Schedule of Contractor-engaged Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Notifying Architect, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

5. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."

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

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

END OF SECTION 01 4000

SECTION 01 4100 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies Federal and State statutes, rules, and regulations that must be followed during execution of Project Work.

1.3 REGULATORY REQUIREMENTS

A. Abide by and follow applicable Federal, State and local codes.

B. Access for Persons with Physical Disabilities: Follow ICC/ANSI A117.1 and ADA including ADA Accessibility Guidelines.

C. Fully comply with Act 247 of 1972 Session of General Assembly of Commonwealth of Pennsylvania, and ensure compliance by lower tier contractors.

D. Discrimination Prohibited: According to 62 Pa. C.S.A. § 3701, Contractor agrees that:

1. In the hiring of employees for the performance of Work under the Contract or any subcontract, no contractor, subcontractor, or any person acting on behalf of the Contractor or subcontractor may by reason of gender, race, creed, or color discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.
2. No Contractor or subcontractor or any person on their behalf may in any manner discriminate against or intimidate any employee hired for the performance of Work under the Contract on account of gender, race, creed, or color.
3. The Contract may be cancelled or terminated by the Owner and all money due or to become due under the Contract may be forfeited for a violation of the terms or conditions of that portion of the Contract.

E. Human Relations Act: The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 (P.L. 744) (43 P.S. Section 951, et. seq.) of the Commonwealth of Pennsylvania prohibit discrimination because of race, color, religious creed, ancestry, age, sex, national origin, handicap, or disability, by employers, employment agencies, labor organizations, contractors, and others. The Contractor agrees to comply with the provisions of this Act as amended that is made part of these Contract Documents. Your attention is directed to the language of the Commonwealth's non-discrimination clause in 16 PA. Code 49.101.Pennsylvania Prevailing Wage Rates: This regulation and the general Pennsylvania prevailing minimum wage rates (Act 442 of 1961, P.L. 987, amended), as determined by the Secretary of Labor and Industry, which must be paid for each craft or classification of workers needed to perform the Contract during the anticipated term thereof in the locality in which public work is performed, are made part of these Contract Documents.

F. Standard of Quality: The various materials and products specified in the Contract Documents by name or description are given to establish a standard of quality and of cost for bid purposes. It is not the intent to limit the bidder, the bid, or the evaluation of the bid to any one material or product specified but rather to describe the minimum standard. When proprietary names are used, they are followed by the words “or alternatives of the quality necessary to meet the requirements of the Contract Documents.” A bid containing an alternative which does not meet the requirements

of the Contract Documents may be declared non-responsive. A bid containing an alternative may be accepted but, if an award is made to that a bidder, the bidder is required to replace any alternatives which do not meet the requirements of the Contract Documents.

G. Provision for the Use of Steel and Steel Products Made in the U.S.: In accordance with Act 3 of the 1978 General Assembly of the Commonwealth of Pennsylvania, if any steel or steel products are to be used or supplied in the performance of the Contract, only those produced in the United States as defined therein may be used or supplied in the performance of the Contract or any subcontracts thereunder.

1. In accordance with Act 161 of 1982, cast iron products are also included and must be produced in the United States. Act 144 of 1984 further defines "steel products" to include machinery and equipment. The act also provides clarifications and penalties.

H. No Cash Allowances: Cash allowances are prohibited under this Contract.

I. FBI Federal Criminal History Records for Prospective Employees:

1. All independent contractors and their employees must provide to their employer a copy of their Federal Criminal History Record from the FBI. Therefore, any person working on this Project and entering upon the Community College property must present an official Record to the District's Business Office before beginning work. Cost of obtaining an official Record, which may not be more than 1 year old, is the responsibility of Contractors' and lower-tier contractors' employees. Notify lower-tier contractors of these requirements.

   a. PDE contracted with Cogent Systems to manage this program for the Commonwealth of Pennsylvania. The management process includes establishing a website, manning a help desk, and establishing fixed site locations for the taking of and transmitting of applicants' fingerprints.

2. All employees (independent contractors and their employees) must have an FBI Federal Criminal History Record. Employees must follow the multiple-step process described below.

   a. The applicant registers before going to the fingerprint site. Walk in service without prior registration is not provided at any fingerprinting location. Registration is completed online or over the phone. Registration is available online 24 hours per day seven days per week at www.pa.cogentid.com. Telephonic registration is available at 1.888.439.2486 Monday through Friday 8 am to 6 pm EST. During the registration process, demographic data for the applicant is collected (name, address, SSN, etc.) so there is no data entry required at the fingerprint collection site.
   b. The applicant pays a $40.00 fee for the fingerprint service and to secure the Criminal History Record. Applicants may make their payment online at www.pa.cogentid.com using a credit card or debit card. Money orders or cashiers checks payable to Cogent Systems are accepted on site for those applicants who do not have the means to pay electronically. No cash transactions or personal checks are accepted.

      1) Cogent Systems establishes a billing procedure for these services from an appropriate requesting agency that is willing to pay the applicant's fee. Billing only occurs after the requesting agency has completed the Cogent Systems' Agency Pay Agreement. To establish a billing account, visit the website www.pa.cogentid.com and download an application. The billing account must be established before sending applicants to the fingerprint site.

   c. The applicant proceeds to the fingerprint site of their choice for fingerprinting. The location of the fingerprint sites and days and hours of operation for each site are posted on Cogent Systems' website www.pa.cogentid.com. Fingerprint site locations may change over time therefore applicants are encouraged to confirm the site location they plan to visit.
   d. At the fingerprint site the Applicant Livescan Operators (ALO) manage the fingerprint collection process.
   e. The fingerprint transaction begins when the ALO reviews the applicant's qualified State or Federal photo ID before processing the applicant's transaction. An approved ID types list can be found on

the Cogent Systems' website www.pa.cogentid.com. Applicants will not be processed if they do not produce an acceptable photo ID.

f. After the identity of the applicant has been established, all fingers and thumbs are scanned to complete the process. The entire fingerprint capture process should take no more than 3 to 5 minutes.

g. The applicant's scanned fingerprints are electronically transmitted to the Pennsylvania State Police who in turn submits the fingerprints and demographic information to the FBI as required by federal statute.

h. PDE receives the Federal Criminal History Record from the FBI. PDE's School Services Unit returns the Federal Criminal History Record to the applicant. The Record is printed on standard 8.5-by 11-inch paper with the Commonwealth Seal imbedded in the paper. This document constitutes the official Record. If an applicant presents their Federal Criminal History Record and the Commonwealth Seal is not embedded in the paper, it is invalid and cannot be accepted as an official Record. If the applicant does not receive the Criminal History Record from PDE within 8 weeks after being fingerprinted, they should call 717.783.3750 or email PDE at dwolfgang@state.pa.us.

i. The applicant then provides the Federal Criminal History Record to their prospective employer (the Community College).

3. Administrators may employ applicants on a provisional basis for a single period not to exceed 90 days, except during a lawful strike proceeding under the provisions of the act of 23 July 1970, known as the "Public Employee Relations Act", when all of the following conditions are met:

   a. the applicant has applied for the information required under subsection (b) and, where applicable, subsection (c) or (c.1) and the applicant provides a copy of the appropriate completed request forms to the Administrator;
   b. the Administrator has no knowledge of information pertaining to the applicant which would disqualify them from employment pursuant to subsection (e);
   c. the applicant swears or affirms in writing that they are not disqualified from employment pursuant to subsection (e);
   d. if the information obtained pursuant to subsection (b), (c), or (c1) reveals that the applicant is disqualified from employment pursuant to subsection (e), the applicant must be suspended and subject to termination proceedings as provided for by law; and
   e. the Administrator requires that the applicant not be permitted to work alone with students and that the applicant work in the vicinity of a permanent employee.

4. Fingerprint Corrections and Resubmissions: In circumstances where a classifiable fingerprint record was not or could not be obtained and immediately upon indication, Cogent Systems takes corrective action to resubmit or reprint the applicant at no cost to the applicant. This corrective action is completed at the earliest possible time and, when applicable, that is convenient for the applicant. Cogent Systems contacts the applicant directly if this occurs. Reprinting can be applied to each applicant one time only. If fingerprinting must take place a third time the applicant must pay the full fee.

5. Group Fingerprinting Support: When there is a requirement to fingerprint a large group of applicants (i.e. a contractor's entire staff of 120 employees). Cogent Systems and the fixed site providers try to accommodate that request. Some fingerprint service sites have the ability to bring portable equipment to your site. If you need Group Fingerprinting Support, visit www.pa.cogentid.com. Service sites in your area that have mobile equipment are listed. This mobile service requires the visited site to provide broadband internet access and access through any firewall. The sites that offer mobile services can provide you instructions in advance of their visit that allow fingerprinting at your site. Requirements for hosting a mobile Livescan operation are found at www.pa.cogentid.com.

   a. We encourage you to utilize this service, but you must plan ahead. Please do not overwhelm the service by sending large groups of applicants to the fixed site locations. If you must send a large group of applicants to a fixed site, please plan for their arrival to occur over days and weeks, not over hours.

6. Confidentiality (Security) of Applicant Information: On-site access to the Livescan equipment and the data traveling from the equipment is comprehensively secured and regulated by both Cogent Systems and the regulations governing the use of that data.

   a. The Computer System: Is housed within a secured network that is protected by firewall devices configured explicitly to allow only permissible protocols and traffic. Cogent Systems ensures that devices procured under this process continue to adhere to the Commonwealth's security requirements. Systems are configured to provide a point of defense with controlled access from both inside and outside the network. The Livescan systems are configured to support logging and audit capability. The Livescan system supports 128 bit encryption.

J. State Police Background Checks of Prospective Employees:

1. Contractor's employees, subcontractors, and subcontractors' employees produce reports of criminal history record from Pennsylvania State Police, or a statement from State Police that State Police central repository contains no criminal history before beginning work on School District Projects. (Different procedures apply with regard to out-of-state employees.) Thus, any person working on this Project and entering upon the Community College property must produce original of said statement to, and leave a copy with, the District's Business Office prior to beginning work. Cost of obtaining said statement, which may not be more than 1 year old, is responsibility of employees of Contractor or lower tier contractors (or their employers), but in no event are they responsibility of the Community College. Notify subcontractors of these requirements.

2. Act 34 of 1985 specifies that employees of public and private schools hired as of January 1, 1986, must undergo background checks. Job applicants must follow procedures listed below.

   a. Procedure for Pennsylvania Residents

      1) Secure Form SP4-164 - Pennsylvania State Police "Request for Criminal History Record Information." Form SP4-164 is available at State Police stations.
      2) Complete Parts I and IV only.

         a) Part I - Ignore SID No. and OTN or OCA No. if none or not known.
         b) Part I - Aliases includes Maiden Name.
         c) Part I - Check boxes for Noncriminal Justice Agency - Individual (Requestor Identification) and Noncriminal Justice Employment (Reason for Request).
         d) Part IV - Check box for Individual - Noncriminal Justice Agency - $10 fee enclosed. Information in Part IV is job applicant's name, address, and telephone number.

      3) Submit completed Form SP4-164 along with a check for $10 to address on reverse side of form.

         a) Make checks payable to "Commonwealth of Pennsylvania."
         b) Personal checks are acceptable.

      4) State Police return background check directly to applicant within 4 weeks.
      5) Present background checks information to prospective employer. Background check is good for 1 year from date of return to applicant.

   b. Procedure for Non-Residents.

      1) Follow same procedures outlined in Steps 1.a. and 1.b. for Pennsylvania residents, filing Form SP4-164 - Pennsylvania State Police "Request for Criminal History Record Information."
      2) Secure an FBI Fingerprint Card from School District or Pennsylvania Department of Education, Bureau of Basic Education Support Services, 333 Market Street, Harrisburg, PA 17126-0333, Telephone 1.717.783.3755.

3. Contractor's employees, subcontractors, and subcontractors' employees produce an "Official Clearance Statement (OCS)" before beginning work on the projects. Thus, any person working on this project and entering upon the Community College property must produce original of OCS to, and leave a copy with, the District's Business Office prior to beginning work. Cost of obtaining OCS, which may not be more than 1 year old, is responsibility of employees of Contractor or lower tier contractors (or their employers), but in no event are they responsibility of the Community College. Notify subcontractors of these requirements.

K. Owner's Compliance in Retaining Payments: Owner retains payments in accordance with 62 Pa. C.S.A. § 3921.

L. Civil Rights Act of 1964, As Amended

1. Contractor agrees to be bound by and comply with provisions of Act of Congress of United States of July 2, 1964, commonly known as "Civil Rights Act of 1964," P.L. 88-352; 42 U.S.C.A. Section 2000a, et seq., and any and all amendments thereto, together with all Rules, Regulations, and Executive Orders issued pursuant thereto, insofar as said Act, Rules, Regulations, and Executive Orders may be applicable to work performed under its Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4100

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in prevailing building codes, as defined by applicable code enforcement authority.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities listed here, unless superseded as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities listed here, unless superseded as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations listed here, unless superseded as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.

c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities listed here, unless superseded as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

A. General: Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide temporary generation, connections, and extensions of electrical service as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Fire safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

B. Landfill Receipts: Submit landfill receipt copies for off site disposal of trash generated during construction with each payment requisition and at contract closeout.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices, General: See WCCC requirements in RFP.

B. Storage and Fabrication Facilities: See WCCC requirements in RFP.

1. Store combustible materials apart from building.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Facility Protection: Conduct activities to minimize the possibility that existing facilities might be damaged from performance of the Work. Provide protective structures where necessary. Restore or repair anything damaged by construction activities to the Owner's satisfaction at no cost to the Owner.

D. Do not subject roof surfaces to traffic nor use them for material storage. Where some activity on roof surfaces is necessary, provide adequate protection such as temporary walkways.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that does not have a harmful effect on completed installations or elements being installed.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. Maintain negative air pressure within work area using HEPA equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.

D. Electric Power supply: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

E. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

F. Telephone Service: Provide temporary telephone service for use by construction personnel.

1. Post a list of important telephone numbers:

    a. Police and fire departments.
    b. Ambulance service.
    c. Contractor's home office.
    d. Contractor's emergency after-hours telephone number.
    e. Architect's office.
    f. Engineers' offices.
    g. Owner's office.
    h. Principal subcontractors' field and home offices.

2. Provide superintendent with cellular telephone or portable two-way radio.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Maintain access for firefighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division 01 Section "Execution."

E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

F. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

G. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."
2. Comply with regulations of local municipality.

C. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

F. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire retardant treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood.

    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

G. Temporary Fire Protection: Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 5000

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Selection of products for use in Project
2. Product delivery, storage, and handling
3. Manufacturers' standard warranties on products
4. Special warranties
5. Comparable products

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
4. Products may also include existing materials or components required for reuse, if so specified.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not, in the judgement of the Architect, meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Division 01 Section "Submittal Procedures."

F. Whenever the words "or equal" appear in the Contract Documents, they shall be interpreted to mean "or alternatives of quality necessary to meet the specifications."

G. Substitution: Refer to Division 01 Section "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Provide material and equipment for incorporated into the Work that:

1. Conforms to applicable specifications and standards.
2. Complies with size, make, type, and quality specified, or as specifically approved in writing by the Architect.

C. Manufactured and Fabricated Products; Generally observe the following, unless otherwise indicated:

1. Design, fabricate, and assemble in accord with specified standards and current standard of care.
2. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
3. Two or more items of the same kind shall be identical, by the same manufacturer.
4. Products shall be suitable for service conditions.
5. Meet or exceed specified equipment capacities, and adhere to sizes, and dimensions shown or specified, unless variations are specifically approved in writing.

D. Do not use material or equipment for any purpose other than that for which it is designed or specified.

E. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

F. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.

    a. Observe referenced industry standards and prevailing building code requirements.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.

b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, 26, 27 and 28 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Contractor shall be responsible for the properly located, secure, and weather resistant storage as required of materials. Place materials so as not to obstruct passage on site or within building structures or in any way which causes impediment or obstruction to normal building operations.

C. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

D. Staging and Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment. Coordinate location with Owner.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store and protect products with manufacturer's seals and labels intact and legible.
4. Store materials in a manner that will not endanger Project structure.

    a. Do not allow excessive loads on building structure.

5. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
6. Store loose granular materials on solid surfaces such as paved areas, or provide plywood or sheet materials to prevent mixing with foreign matter.

    a. Provide surface drainage to prevent flow or ponding of rainwater.
    b. Prevent mixing with refuse, chemically injurious materials, or liquids.

7. Protect stored products from damage and liquids from freezing.

    a. Store cementitious products and materials on elevated platforms.
    b. Protect foam plastic and other UV- and sunlight-sensitive materials from exposure to sunlight, except to extent necessary for period of installation and concealment.
    c. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
    d. Provide substantial platforms, blocking, or skids to support fabricated products above ground, prevent soiling, or staining.
    e. For exterior storage of fabricated products, place on sloped supports, above ground.
    f. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings.

8. Provide off-site storage and protection at no additional cost to Owner when site does not permit on-site storage or protection.

E. Coordination: Coordinate delivery and storage on the jobsite of all significant materials by subcontracts and suppliers. Coordinate delivery and storage of materials on the site with the Owner.

1. Contractor is required to properly instruct material suppliers and vendors to address deliveries to them specifically by named responsible party at the jobsite and require advance notice.
2. Deliveries addressed to the project, in general, the Owner, or Architect, will be refused and returned to shipper.

    a. Owner will not be responsible for receipt, handling, and loss of materials shipped to the Owner in error and received unknowing of relationship to the project.

3. Arrange deliveries of products in accord with project construction schedules, each Contractor to coordinate the deliveries to avoid conflict of work, and to suit site conditions. Notify Owner 48 hours in advance of major deliveries.
4. Promptly inspect shipments to assure that products comply with requirements, are in manufacturer’s original containers with identifying labels intact, quantities are correct, and products are undamaged.
5. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

    a. Enforce transporting and handling of products in accord with manufacturer’s instructions.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.

3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Warranty Period and Timing: Comply with requirements in Division 01 Section "Closeout Procedures."

D. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or alternatives of quality necessary to meet the specifications," or "or approved equal," or "or as otherwise approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Limited List of Products “Available Products”: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

2. Non-Limited List of Products (“Products”): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

    a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

3. Limited List of Manufacturers (“Available Manufacturers”): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

4. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Division 01 Section "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase “match sample” or "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes either standard or standard and premium items, as indicated.

1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Division 01 Section "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Division 01 Section "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Installation of the Work.
2. Cutting and patching.
3. Progress cleaning.
4. Protection of installed construction.
5. Correction of the Work

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

C. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".

D. "Selective Demolition" is recognized as related but separate category of work, which may or may not include cutting and patching as defined in this specification.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

    a. Contractor's superintendent.
    b. Trade supervisor responsible for cutting operations.
    c. Trade supervisor(s) responsible for patching of each type of substrate.
    d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 ACTION SUBMITTALS

A. Request for Instructions:

1. Submit a written request prior to cutting, coring, or alteration which may affect the structural safety or operational performance, including weather tightness, of any portion of the project, or for the following reasons:

    a. To uncover portions of the work for observation of covered work.
    b. To remove samples of installed materials for testing beyond that specified.
    c. To remove work to provide for alteration of previously installed work.

2. Include the following at a minimum:

    a. Identification of the project.
    b. Description of the affected work.
    c. The necessity for doing the cutting, coring, or alteration.
    d. The effect on the work of any separate contractor, or on the structural integrity or operational performance of the project.
    e. Description of the proposed work:

        1) The scope of cutting, patching, coring, or alteration.
        2) The Contractor and trades who will execute the work.
        3) Product proposed to be used.

    f. Alternatives to cutting, coring, or patching.
    g. Designation of the responsibility for the cost of cutting and patching.

3. Submit a written notice designating the date and the time the work will be uncovered.

1.5 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
    b. Provide notification to Owner in advance of service interruptions, as required in General Conditions of the Contract, Summary Sections of Division, and elsewhere in the Contract Documents.

1.6 QUALITY ASSURANCE

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

B. Professional Engineer Qualifications: Refer to Section 01 4000 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Submit a plan for cutting and patching for the following types of systems and equipment:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Conveying systems.
    k. Electrical wiring systems.
    l. Security systems including CCTV and duress alarms.
    m. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Submit a plan for cutting and patching the following types of miscellaneous elements:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Fire stopping
    f. Equipment supports.
    g. Piping, ductwork, vessels, and equipment.
    h. Noise- and vibration-control elements and systems.
    i. Insulating systems.

4. Visual Elements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

E. Cutting and Patching Conference: Before proceeding, meet at the Jobsite with parties involved in cutting and patching. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. Where materials needed to comply with requirements to match adjacent work are not specified in other Sections, request additional direction, or Contract modification where appropriate, from the Architect.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; fiberoptics, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

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

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

3.2 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 01 3100 "Project Management and Coordination."

E. Temporary Support: Provide temporary support of Work to be cut. Confirm structural adequacy and applicable regulatory compliance of temporary supports prior to proceeding with Work.

F. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

G. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

H. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 INSTALLATION

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

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

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

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

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.4 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting, coring, fitting, infill, and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
2. Cut and patch existing construction damaged or defaced during new construction as required to restore to existing or better condition at the time of award of Contract.
3. Cut and patch as required to:

    a. Install or correct non-coordinated or ill-timed Work.
    b. Remove and replace defective and non-conforming Work.
    c. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit
    d. Remove samples of installed Work for testing.

4. Restore the integrity of fire rated construction at cutting and patching work.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Containment: Comply with applicable dust, noise, pollution, fire resistance, and security requirements in Section 01 5000 “Temporary Facilities and Controls”

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with Owner’s Use and notification requirements in Section 01 1000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete in compliance with coordination and other requirements of Section 01 2000 “Summary of Multiple Contracts”

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing. New work shall be indistinguishable from existing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as indicated and as necessary to provide an even-plane surface of uniform appearance.
5. Structural Modifications: Where not shown on Drawings, provide work in accordance with delegated-design provisions specified, subject to Architect’s approval, or request additional information, or Contract modification, from Architect.
6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

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

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

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

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

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

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

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 5000 "Temporary Facilities and Controls."

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

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

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

3.6 PROTECTION AND REPAIR OF INSTALLED and EXISTING CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work, Work in progress, and existing construction affected by construction activities, are without damage or deterioration at time of Substantial Completion.

1. Use proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration Work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Contain dust and debris generated by Work, and prevent it from reaching the public or adjacent surfaces.
5. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
6. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
7. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

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

E. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by Work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

F. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only liquid to pass.

G. Existing Roofing: Prior to the start of Work in an area, provide adequate roofing protection acceptable to Architect.

1. Where existing roofing is covered by a manufacturer’s warranty, perform work in compliance with applicable manufacturer requirements.

H. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

I. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Architect’s and Owner’s approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Architect and Owner at least 72 hours before each occurrence, indicating location of such work.
2. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
3. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
4. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.

5. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.

J. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

3.7 CORRECTION OF THE WORK

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

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 7300

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Closeout submittals
2. Maintenance materials
3. Substantial Completion procedures.
4. Final completion procedures.
5. Punch List
6. Record Documents
7. Warranties.
8. Final adjustment of accounts
9. Final cleaning.
10. Correction and Protection of Work

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: Evidence of compliance with requirements of governing authorities.

1. Certificate of Occupancy.
2. Certificates of Inspection, as follows or as otherwise applicable:

a. Mechanical.
b. Electrical.
c. Fire Marshall.

B. Operating and Maintenance Data: Per requirements of Division 01 Section “Operation and Maintenance Data”.

C. Warranties and bonds.

D. Keys and Keying Schedules.

E. Spare parts and Maintenance materials.

F. Contractor's Affidavit of Payment and Debts and Claims (AIA G706) and Affidavit of Release of Liens (AIA G706A): Per requirements of General Conditions of the Contract for Construction.

G. Final Contractors Weekly Payroll Certifications.

H. Consent of Surety Company to Final Payment (AIA G707).

I. Certificate of Insurance: For continuing coverage.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.
5. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Make final changeover of permanent locks and deliver keys to Owner, as specified. Advise Owner's personnel of changeover in security provisions.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
7. Advise Owner of changeover in utility services.
8. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Advise Owner in changeover of heat and other utilities.
11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
12. Complete final cleaning requirements, including touchup painting.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
14. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
15. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

16. Prepare and submit Project Record Documents, Operation and Maintenance Manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. At least one authorized, responsible representative of each Prime Contractor requesting inspection, with full authority to make decisions on behalf of the Contractor, shall accompany the Architect during the entirety of the inspection. Such Contractor's representatives shall consist of at least one of the following:

    a. Contractor's on-site superintendent
    b. Contractor's project manager

2. The Owner shall be invited, but not required to attend inspections.
3. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

    a. Re-inspection may result in additional costs to Contractor, to reimburse Owner for fees and costs incurred by Architect and its consultants.

4. Results of completed inspection will form the basis of requirements for Final Completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 01 2900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit Final Completion photographic documentation, where required by Contract.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will request Contractor to prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be requested.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
1. If more than one re-inspection is required, the Contractor shall be charged for the Architect's fees, in accordance with the Contract Documents.

1.7 LIST OF INCOMPLETE ITEMS (Punch List)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel Electronic File: Architect will return annotated file.

1.8 PROJECT RECORD DOCUMENTS

A. General: Submit record documents as specified in Section 01 7839 “Project Record Documents.”

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Except as otherwise indicated, submit written warranties as follows.

1. On request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or
2. When delay in submittal of warranties might limit Owner's rights under warranty, or
3. On request of Architect for designated portions of the Work that have been determined to be substantially complete, or
4. At Project Closeout for otherwise unsubmitted warranties.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect or by email to Architect.

1.10 FINAL ADJUSTMENT OF ACCOUNT

A. Submit a final statement of accounting to Architect.

B. Statement shall reflect adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:

a. Previous Charge Orders.
b. Unit Prices.
c. Deductions for uncorrected work.
d. Deductions for liquidated damages.
e. Deductions for re-inspection payments.
f. Other adjustments.

3. Total Contract Sum, as adjusted.
4. Previous Payments.
5. Sum remaining due.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

C. Unless otherwise directed in writing, complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
3. Remove tools, construction equipment, machinery, and surplus material from Project site.
4. Clean exposed exterior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
5. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
6. Remove labels that are not permanent.
7. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

8. Wipe surfaces of mechanical and electrical equipment and similar equipment.
9. Clean strainers.
10. Leave Project clean and ready for occupancy.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 PROTECTION AND REPAIR OF THE WORK

A. Provide final protection, maintain conditions that ensure that Work and existing construction are without damage or deterioration, and complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.
2. Submit three paper copies. Architect will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.

5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. Organization: Include a section in the directory for each of the following:

a. List of documents.
b. List of systems.
c. Table of contents, coordinated with the Project Manual.

2. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
3. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
4. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

3.2 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

1. Include emergency information that must be immediately available during emergency situations to protect life and property and to minimize disruptions to building occupants

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

3.3 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures. Include information needed for daily operation and management of systems and equipment.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.

10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

3.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts (if required): Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

3.5 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned record prints and three set(s) of file prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files and paper copies of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories and three paper copies of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding photographic documentation.
    f. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Architect's RFI responses.
    n. Supplemental, Clarification, and Field Sketches issued during the Project
    o. Field records for variable and concealed conditions.
    p. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect and Owner's Representative. When authorized, assemble one full set of corrected Record Contract Drawings and Shop Drawings for submission to the Owner.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
2. Refer instances of uncertainty to Architect for resolution.

C. Record Electronic Files: Upon completion of the Record Drawings, scan the full set of Record Drawings into a PDF format and forward to Architect by uploading to project FTP site. Properly label with project name, number, date, and title "Final Record Drawings."

D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

3.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file and paper copies.

3.3 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file and paper copies.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

3.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file and paper copies.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

3.5 RECORDING AND MAINTENANCE

A. Recording:

1. Maintain one copy of each submittal during the construction period for Project Record Document purposes.
2. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples:

1. Store Record Documents and Samples in the field office apart from the Contract Documents used for construction.
2. Do not use Project Record Documents for construction purposes.
3. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss.
4. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 7839

SECTION 02 4119 - SELECTIVE STRUCTURE DEMOLITION

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. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective 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 selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.
6. Review building construction phasing plan.
7. Review demolition waste recycling requirements in another Division 02 Section.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Furnishings not attached to building.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

C. Requirements for Building Reuse:

1. Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
2. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
3. Maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required at each phase.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 5000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not 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 fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See other Division 07 Specification Sections for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Existing Construction to Be Removed: See Drawings.

END OF SECTION 02 4119

SECTION 03 3000 – 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes for the following.

1. Slabs-on-grade.
2. Suspended slabs.

B. Coordination: Unless other satisfactory agreements are specifically entered into by contractors concerned, all miscellaneous iron and steel, sleeves, anchors, etc., required by work of other contractors, will be furnished and installed by such other contractors with the cooperation of this contractor.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Laboratory test reports for concrete mix design with the following data:

1. Method used to determine the proposed mix design (per ACI 301, Article 4.2.3).
2. Gradation and quantity of fine and coarse aggregates.
3. Proportions of all ingredients including all admixtures added either at the time of batching or at the job site.
4. Water/cement ratio and water/cementitious ratio.
5. Slump - ASTM C143.
6. Certification and test results of the total water-soluble chloride ion content of the design mix - FHWA RD-77 or AASHTO T 260-84.
7. Air content of freshly mixed concrete by the pressure method, ASTM C231, or the volumetric method, ASTM C173.
8. Unit weight of concrete - ASTM C138.
9. Strength at 7 and 28 days - ASTM C39, and 3-day strength for post-tensioned concrete. Document strength on basis of previous field experience or trial mixtures per ACI 301 Article 4.2.3. Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard calculation, and determination of required average compressive strength.

D. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

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

F. Material Test Reports or Certificates: Submit material test reports from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials, or submit material certificates signed by manufacturers certifying that each of the following items complies with requirements:

1. Aggregates.
2. Cementitious materials and aggregates.
3. Form materials and form-release agents.
4. Steel reinforcement and reinforcement accessories.
5. Admixtures.
6. Waterstops.
7. Curing materials.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Epoxy joint filler.
13. Joint-filler strips.
14. Repair materials.

G. Minutes of pre-installation conference.

1.5 QUALITY ASSURANCE

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

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.

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

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.
3. For additional definitions and requirements, refer to Quality Control – “Special Structural Testing and Inspection” section of these Specifications.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from a single manufacturer.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete" Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
e. Agency responsible for field quality control.
f. Primary admixture manufacturers.

2. Review special structural testing and inspection and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, Class I zinc coated after fabrication and bending.

D. Epoxy-Coated Reinforcing Bars: ASTM A 706/A 706M, deformed bars, ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

E. Stainless-Steel Reinforcing Bars: ASTM A 955/A 955M, Grade 60 (Grade 420), Type 316L, deformed.

F. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars, assembled with clips.

G. Plain-Steel Wire: ASTM A 82, galvanized.

H. Deformed-Steel Wire: ASTM A 496.

I. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

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

K. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

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

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
3. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I gray. Supplement with the following:

   a. Fly Ash: ASTM C 618, Class C or F with no exception to 6% maximum loss on ignition.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal for foundations.
2. Maximum Course-Aggregate Size: 3/4" (19mm) for all other concrete.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
7. Accelerating Admixture: ASTM C494, Type E.
8. Accelerating Water-Reducing Admixture: ASTM C494, Types C and E.

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:

a. Raven Industries Inc.; VaporBlock 15.
b. Stego Industries, LLC; Stego Wrap, 15 mils.
c. W. R. Meadows, Inc.; Perminator 15 mils.
d. FortiFiber Corporation; Moistop Ultra 15.
e. Insulation Solutions, Inc.; Viper II 15 mils.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:

a. Axim Concrete Technologies; Cimfilm.
b. ChemMasters; Spray-Film.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
d. Dayton Superior Corporation; Sure Film.
e. Euclid Chemical Company (The); Eucobar.
f. MBT Protection and Repair, Div. of ChemRex; Confilm.
g. Meadows, W. R., Inc.; Sealtight Evapre.
h. Sika Corporation, Inc.; SikaFilm.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products:

a. ChemMasters; Safe-Cure Clear.
b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
c. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
d. Euclid Chemical Company (The); Kurez DR VOX.
e. Meadows, W. R., Inc.; 1100 Clear.
f. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures. Trial batch and field experience tests shall have been performed within 12 months of submittal date.

2. Do not use the same testing agency for field quality control testing.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. All mix designs shall be submitted on the Mix Design Submittal Form included at the end of this specification. Do not begin concrete production until proposed mix designs have been reviewed by Architect. The approved mix designs shall be used throughout this project unless changes are approved by Architect/Engineer prior to use.

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

D. Air Content of Indoor Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.

E. Air Content of Concrete Exposed to Freezing and/or De-icing Chemicals: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:

1. Air Content: 5.5 percent for 1-1/2" (38 mm) nominal maximum aggregate size.
2. Air Content: 6 percent for 1" (25 mm) nominal maximum aggregate size.
3. Air Content: 6 percent for 3/4" (19 mm) nominal maximum aggregate size.

F. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

G. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

H. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg. F. (10 deg. C.).

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days, non-air-entrained.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).

B. Interior Slabs-on-Grade, Grade Beams, Wallsand Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days, non-air-entrained.
2. Minimum Cementitious Materials Content: 540 lb/cu. yd. (320 kg/cu. m).
3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).
4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.
5. Maximum water-cementitious material ratio: 0.50

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 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.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Earth cuts may be used as forms for footing vertical surfaces, if sides are sharp and true, and not exposed in finished structure.

C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-concrete exposed to view.
2. Class C, 1/2 inch (13 mm) for other concrete surfaces.

E. Construct forms tight enough to prevent loss of concrete mortar.

F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

1. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

N. 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.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. No aluminum conduit shall be installed in concrete.
4. No sleeves, holes, or inserts shall be placed within 2'-0" of columns without approval of the structural engineer.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved 75 percent of its 28-day design compressive strength. At cantilevers, 100% of its 28-day design compressive strength must be achieved.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Granular Course: Place slab on grade on 4"-thick fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

B. Plastic Vapor Retarders: Cover 4" granular material with plastic vapor retarder, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Where reinforcement is in top (top 3") of all concrete exposed to freeze-thaw conditions, use epoxy-coated bars.

G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. If joint pattern is not shown, provide joints at a maximum spacing in feet of 3 times the slab thickness in inches in each direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays). Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. No concrete shall be placed except when Architect's representative (or independent testing laboratory) is present unless this requirement is specifically waived by the Architect. Give adequate notice to the Architect, the testing laboratory, and all contractors affected before placing concrete.

C. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified. Concrete delivery tickets shall show:

1. Batch number
2. Mix by number with cement content in pounds and maximum size aggregate
3. Admixtures
4. Air content.
5. Slump
6. Time of loading

D. Discharge concrete within 1-1/2 hours after water has been added to the cement, unless a longer time has been authorized by the Architect/Engineer. During hot weather or other conditions contributing to a quick stiffening of the concrete, the Architect/Engineer may require discharge in less than 1-1/2 hours. If loss of slump occurs, HRWR may be redosed at the site as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer and the manufacturer at the Pre-Concrete Conference.

E. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

F. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

G. Place interior slabs on grade that will later receive floor coverings only after floor level or roof above has been placed. Also, protect the slab from any moisture infiltration until building is complete.

H. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

I. Pumping Concrete: Grout used to prime a pump shall not be placed in the forms in any concrete exposed to view in the final structure.

J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

K. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. 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.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155/E 1155 M for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15 for carpeted slabs.

   b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

   c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

3. Finish and measure surfaces of slabs placed on unshored form surfaces and/or shored form surfaces after the removal of shores, so gap at any point between concrete surface and an unleveled free-standing 10' (3.05-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4" (6.4 mm). F_L levelness tolerances shall not apply to cambered or inclined surfaces.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

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

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the 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.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Moist cure interior and exterior concrete to be exposed to de-icing salts.

4. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.016 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 QUALITY CONTROL – SPECIAL STRUCTURAL TESTING AND INSPECTION

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Definitions:

1. Special Inspector – Technical:

   a. Technical I: ACI-Certified Grade I Inspector: Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
   b. Technical II: ACI-Certified Grade II Inspector: Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
   c. Technical III: A civil/structural engineer regularly engaged in this type of work, with a minimum of 4 years experience and licensed in the state in which the project is located and is an employee of a qualified and approved testing laboratory. The licensed engineer shall review and approve all reports.
   d. Testing laboratory shall have C.C.R.L. certification at the National Bureau of Standards.

2. Special Inspector – Structural:

   a. Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a Structural II.
   b. Structural II: Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the state in which the project is located. The licensed engineer shall review and approve all inspection reports.
   c. Special Inspector: Structural may be an employee of the SER.

C. Structural Testing and Special Inspection Requirements:

1. Verify and inspect reinforcement in all cast-in-place concrete work:

   a. Verify reinforcing bar grade.
   b. Verify reinforcing bars are free of dirt, excessive rust, and damage.
   c. Verify reinforcing bars are adequately tied, chaired, and supported to prevent displacement during concrete placement.
   d. Verify proper clear distances between bars and to surfaces of concrete.
   e. Verify reinforcing bar size and placement.
   f. Verify bar laps for proper length and stagger.

2. Perform concrete mix verification:

   a. Verify mixer truck trip ticket conforms to approved mix design.
   b. Verify that total water added to mix on site does not exceed that allowed by concrete mix design.
   c. Verify that concrete quality is indicative of adequate mixing time, consistency, and relevant time limits.

3. Inspect preparation and placement of all concrete:

   a. Verify the following:

      1) Verify acceptable general condition of concrete base prior to placement.
      2) Verify use of required design mixtures.
      3) Verify concrete placement, including conveyance and depositing avoids segregation and contamination.
      4) Verify that concrete is properly consolidated.
      5) Verify reinforcement remains at proper location.
      6) Unless noted, inspections shall be continuous. Inspections shall be performed on a periodic basis for the following types of work: None.

4. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

   a. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

      1) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

   b. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

   c. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   d. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

   e. Microwave Test: The water content of freshly mixed concrete will be tested on a random basis during placement using Microwave Drying Oven, in accordance with AASHTO TP23, "Proposed Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying." This test will be performed only on concrete exposed to weather.
   f. Compression Test Specimens: ASTM C 31/C 31M.

1) Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

g. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

1) Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
2) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

h. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

i. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

j. Non-Compliant Test Reports: All test reports indicating non-compliance should be faxed immediately to all parties on the test report distribution list. Copies shall be on different colored paper.

k. Non-destructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

l. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

m. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

n. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

5. Observe protection and curing methods and maintenance of curing temperature for all concrete:

a. Verify the following:

1) Verify that specified curing procedures are followed.
2) Verify that specified hot and cold weather procedures are followed.

6. Verify concrete strength before removal of shores and forms from beams and slabs.

7. Inspect all bolts, headed bolts, and headed studs installed in concrete.

a. Verify specified size, type, spacing, configuration, embedment, and quantity.
b. Verify proper concrete placement and means have been taken to achieve consolidation around all bolts.

D. Conventional testing and inspection requirement.

1. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

CONCRETE MIX DESIGN

SUBMITTAL FORM

Part 1

CONCRETE SUPPLIER INFORMATION

Form Submitted by:

Initials of person submitting:_____ Phone Number:_____

Company Name:_____
Address:_____
_____
Main Plant Location:_____
Miles from Project:_____
Secondary Plant Location:_____
Miles from Project:_____
Date:_____

PROJECT INFORMATION

Project:_____
City:_____
General Contractor:_____
Concrete Strength (Class):_____
Air Content:_____
Density:_____

Use (describe): _____

This form shall be completed for each concrete strength (Class) and is based upon ACI 301-05.

Part 2

Determine Required Average Compressive Strength

(Check which method to be used)

If a group of at least 15 consecutive compressive strength tests meeting the requirements of ACI 4.2.3.1 are available, calculate the standard deviation and required average compressive strength from (ACI EQ. 4-1 and tables 4.2.3.3.b and 4.2.3.3.a)

No. of Tests:_____

Standard Deviation:____

k-factor:_____

f'_{cr}: ___

If no field compressive strength tests are available, select required average compressive strength from (Table 4.2.3.3.c)

Data:

f'_{cr}: _____

Recorded Field Test Data		
Test	Date	f'c
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Part 3

Determine Actual Concrete Compressive Strength

Two methods of determining compressive strength are acceptable. Field Test Data Method and Trial Mix Method, select **one** method and provide the data required as described.

Field Test Data Method:

Provide design Materials, Types, Specific Gravity, Weight and Volume for the concrete being tested. Utilize the following table. Mix #2 is not required if more than 10 consecutive strength tests for one mixture are available. See ACI 4.2.3.4.a for additional information and requirements.

Materials	Type/Source		Specific Gravity		Weight (lbs.)		Absolute Volume (Cu. Ft.)	
Mix	#1	#2	#1	#2	#1	#2	#1	#2
Cement								
Flyash								
Microsilica								
Coarse Aggregate								
Fine Aggregate								
Water								
Air								
Other								
TOTAL							27.0 cu. ft.	

Water/Cementitious Ratio (lbs. water/lbs. cementitious material) = _____

Admixtures	Manufacturer	Dosage (oz./cwt.)	
Mix	-	#1	#2
Water Reducer			
Air-Entraining Agent			
High-Range Water Reducer			
Non-Corrosive Accelerator			
Other			

Provide compressive test results from above mixture/s.

-*If one mix is used:*

Average compressive strength (f'_c):____

Required compressive strength (f'_{cr}):____
(See Part 2)

-*If two mixes are used*, plot the relationship between the water-cement ratio and the average compressive strength for each mix, and interpolate the plot to determine the correct water to cement ratio required to meet the compressive strength determined in Part 2. Attach plot with notation showing the proper water cement ratio

Field Test Data					
Mix #1	Date	f'c	Mix #2*	Date	f'c
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
Average	-		Average	-	

* Mix #2 not required if 10 consecutive compressive tests are provided for Mix#1

Required Compressive Strength (f'_{cr}):_____
(See Part 2)

Water-cementitious ratio:_____
(From interpolation)

Establish the mixture proportions for f'cr based upon the required water cementitious ratio. Use the table below to show the actual mixture used on the project.

Materials	Type/Source	Specific Gravity	Weight (lbs.)	Absolute Volume (Cu. Ft.)
Cement				
Flyash				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Air				
Other				
TOTAL				27.0 cu. ft.

(If one trail mix was used the mixture will match Mix #1)

Trial Mixture Method:

Provide 3 design mixtures including: Materials, Types, Specific Gravity, Weight and Volume for the concrete being tested. The following table has been provided to store this data. If the submitted data does not encompass all the required information the submittal will be rejected. See ACI 4.2.3.4.b for additional information and requirements.

Materials	Type/Source			Specific Gravity			Weight (lbs.)			Absolute Volume (Cu. Ft.)		
Trial Mixture	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
Cement												
Flyash												
Microsilica												
Coarse Aggregate												
Fine Aggregate												
Water												
Air												
Other												
Total										27.0 cu. ft.		

Water/cementitious material Ratio = #1_____ #2_____ #3_____
(lbs. water/lbs. cementitious material)

Admixtures	Manufacturer	Dosage oz./cwt.		
Trial Mixture	-	#1	#2	#2
Water Reducer				
Air-Entraining Agent				
High-Range Water Reducer				
Non-Corrosive Accelerator				
Other				

Provide compressive test results from above mixtures.

Trial Mix Test Data								
Mix #1	Date	f'c	Mix #2	Date	f'c	Mix #3	Date	f'c
1			1			1		
2			2			2		
3			3			3		
Average	-		Average	-		Average	-	

Plot the average compressive strength versus the corresponding water cement ratio and read the curve to determine the proper water-cementitious material ratio to meet the required compressive strength from Part 2. Attach plot and notation indicating the proper ratio to meet the required compressive strength.

Required Compressive Strength (f'_{cr}):_____
(See Part 1.)

Water/cementitous material Ratio:_____
(From interpolation)

Establish the mixture proportions for f'cr based upon the required water cementitious ratio. Use the table below to show the actual mixture used on the project

Materials	Type/Source	Specific Gravity	Weight (lbs.)	Absolute Volume (Cu. Ft.)
Cement				
Flyash				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Air				
Other				
TOTAL				27.0 cu. ft.

Additional Requirements/Information

Please provide the following attachments: (Initial if attached)

Coarse Aggregate Gradation Report _____
Fine Aggregate Gradation Report _____
Concrete Compressive Strength Data or Trial Mixture Test Data _____
Admixture Compatibility Certification Letter _____
Plots required to determine w/c ratio_____

SECTION 03 5416 - HYDRAULIC CEMENT UNDERLAYMENT

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 hydraulic-cement-based underlayment for use below interior floor coverings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Manufacturer Certificates: Signed by manufacturers of both underlayment and floor covering system certifying that products are compatible.

C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of both underlayment and floor covering system certify in writing that products are compatible.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.

1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.7 COORDINATION

A. Coordinate application of underlayment with requirements of floor covering products, including adhesives, specified in Division 09 Sections, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ardex; K-15 Self-Leveling Underlayment Concrete.
    b. Bonsal, W. R. Company; Self-Leveling Underlayment.
    c. Conspec, a Dayton Superior Company; Conflow.
    d. Dayton Superior Corporation; LeveLayer I.
    e. Dependable Chemical Co., Inc.; Skimflow ES.
    f. L&M Construction Chemicals, Inc.; Levelex.
    g. MAPEI Corporation; Ultraplan 1.
    h. Maxxon Corporation; Level-Right.

2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, adhesives, coatings, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.

C. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to produce surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 5416

SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

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 the following:

1. Wood blocking, cants and nailers.
2. Wood sleepers.
3. Plywood backing panels.
4. Wood Furring and grounds.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominalor greater but less than 5 inches nominalin least dimension.

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: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Expansion anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. 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.
3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction containing no arsenic or chromium or petroleum solvents.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood, cants, nailers, blocking, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood blocking, furring, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Mixed southern pine; SPIB.
2. Western woods; WCLIB or WWPA.
3. Northern species; NLGA.
4. Eastern softwoods; NeLMA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NELMA.
3. Northern species, No. 2 Common grade; NLGA.
4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inchnominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel. Where carpentry in these environments is treated with corrosive materials, provide fasteners of Type 316 stainless steel.
2. Do not use stainless steel fasteners for attachment to carbon steel items. For this application provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Mechanical Fasteners for Roofing: Fastening devices to suit substrate and as recommended by roofing membrane manufacturer.

1. Use only FMG Approved for 1A90 and UL listed fasteners.

C. Steel Drill Screws: ASTM C 1002 for fastening wood panels to steel members, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

D. Wood screws following ANSI B18.6.1 for fastening steel framing to wood blocking.

E. Nails: ASTM F 1667.

F. Power-Driven Nails: NES NER-272.

G. Wood Screws: ASME B18.6.1.

H. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

I. Lag Bolts: ASME B18.2.1.

J. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

K. 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 (Interior): Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material (Exterior Walls and Roofs): Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

L. Other Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.
2. Type: Undercut anchors.
3. Corrosion Protection (Interior): Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe.Zn 5 (5 microns) for Class SC 1 service condition (mild).
4. Corrosion Protection (Exterior Walls and Roofs): Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836Mm Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM 276, Type 304 or 316, for anchors.
5. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.

6. For Postinstalled Anchors in grouted Masonry Units: Capability to sustain, without failure, a load equal to four times the loads imposed.

M. Available Products: Subject to compliance with the following, provide one of the following products:

1. Screws: Stainless-Steel, Type 316.

a. Swan Secure Products, Inc.; Sharx™ Flat Head.

2. Nails: Stainless-Steel, Type 316.

a. Swan Secure Products; Inc.; Permanent Wood Foundation Nails with Annular Ring Thread.

3. Parapet Fasteners:

a. Carlisle SynTec Systems Div. of Carlisle Corp.; Sure-Seal® HP Termination Bar Nail-Ins.
b. Firestone Building Products Co.; Coated Drive Pin Fastener.
c. GenFlex Roofing Systems; GenFlex Zinc Masonry Fastener.
d. Versico Inc.; Versico Zinc nail-In Anchors.

4. Chemical Anchors:

a. Powers Fastening Inc.; Hammer-Capsule™.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Provide blocking as indicated and as required to support fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 incheso.c.

C. Provide fire blocking in concealed cavities as indicated and as follows:

1. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

1. Attach wood nailers for roofing to the structure following FMG LPD 1-49 “Perimeter Flashing.” Minimum nailer size is 2 by 6.
2. Anchor the first wood nailer to masonry walls with 1/2 inch diameter Type 316 stainless steel bolts and to structural steel with 3/4 inch diameter hot-dip galvanized steel bolts spaced 4 feet on center.

    a. At outside building corners space bolts 2 feet on center for 8 feet each way from corner.
    b. Fill top 16 inches of masonry wall with concrete and embed bolts at least 12 inches into concrete filled masonry.
    c. Use chemical anchors and embed bolts at least 12 inches into existing masonry.
    d. If wood nailer is wider than 6 inches, stagger bolts.

3. Anchor first wood nailer at steel deck as follows:

    a. Nailer Parallel to Ribs (Steel Deck Span 7 feet or Less): Anchor nailer to each roof joist with 3/4 inch diameter hot-dip galvanized steel bolts.
    OR AT CONTRACTOR’S OPTION
    b. Nailer Parallel to Ribs: Screw nailer to steel deck with 2 staggered rows of No. 10 hot-dip galvanized steel sheet metal screws spaced 24 inches on center. Use a 5/8 inch outside diameter hot-dip galvanized steel washer under screw heads. For 8 feet each way from outside corners space screws 12 inches on center.
    c. Nailer Perpendicular to Ribs: Screw nailer to steel deck with 2 staggered rows of No. 10 hot-dip galvanized steel sheet metal screws spaced 24 inches on center. Use a 5/8 inch outside diameter hot-dip galvanized steel washer under screw heads. For 8 feet each way from outside corners space screws 12 inches on center.

4. Anchor wood to wood with Type 316 stainless steel nails long enough to penetrate underlying wood at least 1-1/2 inches.

    a. Install nails in 2 staggered rows with spacing in any one row 24 inches on center. For 8 feet each way from outside corners space nails 12 inches on center.
    b. Use nails with a withdrawal resistance of not less than 100 lbf per nail. Lag screws of equivalent strength may be used in place of nails.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1053

SECTION 07 1905 – VAPOR CONTROL FOR FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specifications Sections apply to this Section.

1.2 SUMMARY

A. Section includes treatments for the following horizontal surfaces:

1. Interior concrete slabs on grade scheduled to receive flooring, except locations scheduled to receive porcelain tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Installation Instructions

C. Test Results for the following performed before and after treatment:

1. Concrete moisture test results for ASTM F 1869.
2. Concrete moisture test results for ASTM F-2179 (in situ probe test).
3. Test results for alkalinity
4. Include floor plan indicating date and place of each probe that correlates to test results.

D. Letter from flooring adhesive manufacturer for each type of flooring adhesive stating that their product will adhere to the concrete surface after treatment with the vapor control product and that their product warranties will not be voided.

E. Site visit reports by manufacturer's representatives if required as condition of Warranty.

F. Sample of Warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: When manufacturer requires product to be installed by approved installers, submit evidence of certification. Installer must be currently certified and must have been certified for a minimum of three years prior to the date of product installation on this Project.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 DEFINITIONS

A. MVER: Moisture Vapor Emission Rate

B. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

C. ASTM F 2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using In Situ Probes.

PART 2 - PRODUCTS

2.1 VAPOR CONTROL FOR FLOORING

A. General:

1. The purpose of the topically applied vapor control product is to mitigate a high moisture condition within concrete and to reduce the pH level so that impermeable flooring adhesives and flooring products may be installed without loss of adhesion due to moisture migration from free water in the slab or from the ground below.

    a. Vapor Control products should not be used unless the test results, as specified below, warrant the treatment of the concrete.
    b. The product selected must be able to reduce the MVER by at least 8 lbs/sf/24 hours according to calcium chloride test method ASTM F 1869, or sufficient to reduce the vapor emission of the concrete to 3 lbs/sf/24 hour.
    c. Reactive penetrants using sodium silicate, potassium silicate or lithium silicate are prohibited.
    d. Minimum Warranty period for the product is 5 (five) years.

B. Epoxy-based Moisture Control System:

1. Manufacturers and Products: Subject to compliance with requirements, provide products by the following::

    a. ARDEX Engineered Cements, Aliquippa, PA

        1) Epoxy-based Moisture Control System Product: ARDEX MC RAPID
        2) Semi-Rigid Epoxy Crack and Joint Filler Product: ARDEX ARDISEAL 2C.
        3) Movement Joints Product: ARDEX ARDISEAL RAPID.
        4) Primer for Underlayment Product: ARDEX P82 ULTRA PRIME.
        5) Portland Cement-based Underlayment Product: ARDEXK55 MICROTEC.
        6) Telephone: 724-203-5000.
        7) Website: www.ardex.com.

PART 3 - EXECUTION

3.1 PRE-TESTING

A. Test all concrete slabs which are to receive floor coverings in accordance with ASTM F 1869. If moisture is present and above 3 lb/sf/24 hours, test those areas with ASTM F 2170.

B. Verify that the product specified to lower moisture emission and pH levels is able to reduce moisture emission rate to 3 lb/sf/24 hour or less.

3.2 PREPARATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to vapor control treatment manufacturer's requirements.
2. Inspect for previously applied treatments that may inhibit penetration or absorption of vapor control product.
3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of vapor control.
4. Verify that required repairs are complete, cured, and dry before applying vapor control.

B. Cleaning: Before application of moisture control system, clean substrate of substances that could impair penetration or performance of product according to manufacturer's written instructions, such as sealers, dirty, dust, paint, adhesive residues or other contaminants that interfere with product penetration and bond.

1. Mechanical preparation of the surface is required to obtain a minimum ICRI concrete profile of 3 (CSP 3). The substrate preparation must be by mechanical means, such as shot blasting. Broom sweep and vacuum the prepared surface.
2. To determine that the concrete is penetrable, perform a water absorbency test by applying water to a representative portion of the prepared concrete floor. An absorbent surface when dry will immediately absorb clean water without any surface beading effect.

3.3 ENVIRONMENTAL CONDITIONS

A. General: If not directed otherwise by manufacturer, the area to be treated should be conditioned at 70° F or more with a maximum humidity of 60% or less for 48 hours prior to application. Concrete slab temperature should be a minimum of 55° F. Once applied the area must be kept at 70° F and 60° F for 72 (seventy two) hours. If manufacturer’s environmental conditions are not established and maintained, products may require longer drying/set-up time. Freezing temperatures or excessive humidity may prevent products from performing properly.

3.4 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of vapor control product and to instruct Applicator on the product and application method to be used.

1. Prepare field report as required by Manufacturer for warranty.

B. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

3.5 FINAL CLEANING

A. Immediately clean product from adjoining surfaces and surfaces soiled or damaged by vapor control application as work progresses. Correct damage to work of other trades caused by vapor control application.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 1905

SECTION 07 8446 - FIRE-RESISTIVE JOINT SYSTEMS

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. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

1.3 DEFINITIONS

A. Class I movement refers to expansion or contraction joints in UL 2079, Table 9.1.

B. Class II movement refers to wind-sway joints in UL 2079, Table 9.1.

C. Static joints with no movement capability are designated by “S”.

D. Dynamic joints with movement capability are designated by “D”.

E. “FF” floor to floor joint system.

F. “WW” wall to wall joint system.

G. “FW” floor to wall joint system.

H. “HW” head of wall joint system.

I. “BW” bottom of wall joint system.

J. “CG” wall to wall joints intended for use as corner guards.

K. “CW”: perimeter fire-resistive joint system.

L. DRI: Designated Responsible Individual who has demonstrated through successful testing, a knowledge of the FCIA Firestop Manual of Practice.

M. FCIA: Firestop Contractors International Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Fire-Resistive Joint System Product Schedule: For each fire-resistive joint system. See sample format at end of Part 3.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1. Installer must have a “DRI”.

B. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Installer Responsibility: Assign installation of fire-resistive joint systems and penetration firestopping to a single qualified Installer. See other Division 07 Section for Penetration Firestopping requirements. Select system for each joint in rated partitions.

D. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:

    a. Fire-resistive joint system products bear classification marking of qualified testing agency.
    b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:

        1) UL in its "Fire Resistance Directory."
        2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. In fire-rated partitions, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

1. Joint system must match rating of the partitions in which they are installed.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. A/D Fire Protection Systems Inc.
    b. CEMCO.
    c. Fire Trak Corp.
    d. Grace Construction Products.
    e. Hilti, Inc.
    f. Johns Manville.
    g. Nelson Firestop Products.
    h. NUCO Inc.
    i. Passive Fire Protection Partners.
    j. RectorSeal Corporation.
    k. Specified Technologies Inc. (STI)
    l. 3M Fire Protection Products.
    m. Tremco, Inc.; Tremco Fire Protection Systems Group.
    n. USG Corporation.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. A/D Fire Protection Systems Inc.
    b. Grace Construction Products.

c. Hilti, Inc.
d. Johns Manville.
e. Nelson Firestop Products.
f. NUCO Inc.
g. Passive Fire Protection Partners.
h. RectorSeal Corporation.
i. Specified Technologies Inc. (STI)
j. 3M Fire Protection Products.
k. Thermafiber, Inc.
l. Tremco, Inc.; Tremco Fire Protection Systems Group.
m. USG Corporation.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A/D Fire Protection Systems Inc.
b. Grace Construction Products.
c. Hilti, Inc.
d. Johns Manville.
e. Nelson Firestop Products.
f. NUCO Inc.
g. Passive Fire Protection Partners.
h. RectorSeal Corporation.
i. Specified Technologies Inc. (STI)
j. 3M Fire Protection Products.
k. Tremco, Inc.; Tremco Fire Protection Systems Group.
l. USG Corporation.

E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Low-Emitting Materials: Fire-resistive joint system 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."

H. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system 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 fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E 2393.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE – SAMPLE FORMAT

A. The categories listed below are not all-inclusive, but are intended to illustrate a format. Add categories, or additional conditions, to provide a system for each required fire-resistive joint in the Work.

B. Floor-to-Floor, Fire-Resistive Joint Systems (FF):

1. Floor Materials:
2. UL-Classified Systems:
3. Assembly Rating: Insert number of hours.
4. Nominal Joint Width: Insert dimension.
5. Movement Capabilities: Insert compression, extension, or horizontal shear.
6. W-Rating: No leakage of water at completion of water leakage testing.

C. Wall-to-Wall, Fire-Resistive Joint Systems (WW):

1. Wall Materials:
2. UL-Classified Systems:
3. Assembly Rating: Insert number of hours.
4. Nominal Joint Width: Insert dimension.
5. Movement Capabilities: Class I, Class II or Class III – Insert percent compression or extension.

D. Floor-to-Wall, Fire-Resistive Joint Systems (FW):

1. Floor Material and Wall Material:
2. UL-Classified Systems:
3. Assembly Rating: Insert number of hours.
4. Nominal Joint Width: Insert dimension.
5. Movement Capabilities: Class I, Class II - Insert percent compression, extension, or horizontal shear.

E. Head-of-Wall, Fire-Resistive Joint Systems (HW):

1. Wall and Ceiling Materials:
2. UL-Classified Systems:
3. Intertek ETL SEMKO-Listed Systems:
4. Assembly Rating: Insert number of hours.
5. Nominal Joint Width: Insert dimension:
6. Movement Capabilities: Class I or Class II – Insert percent compression or extension.

F. Bottom-of-Wall, Fire-Resistive Joint Systems (BW):

1. Wall Material and Floor Material:
2. UL-Classified Systems:
3. Assembly Rating: Insert number of hours.
4. Nominal Joint Width: Insert dimension.
5. Movement Capabilities: Class I or Class II - Insert percent compression or extension.

G. Wall-to-Wall, Fire-Resistive Joint Systems Intended for Use as Corner Guards (CG):

1. Wall Materials:
2. UL-Classified Systems:
3. Assembly Rating: Insert number of hours.

4. Nominal Joint Width: Insert dimension.
5. Movement Capabilities: Class I or Class II - Insert percent compression or extension.

H. Perimeter Fire-Resistive Joint Systems (CW):

1. Perimeter Materials:
2. UL-Classified Perimeter Fire-Containment Systems:
3. Intertek ETL SEMKO-Listed, Perimeter Fire-Barrier Systems: Select equivalent system to UL.
4. Integrity Rating: Insert number of hours.
5. Insulation Rating: Insert number of hours.
6. Linear Opening Width: Insert dimension, maximum.
7. Movement Capabilities: Class I or Class II - Insert percent compression or extension.

END OF SECTION 07 8446

SECTION 07 9200 - JOINT SEALANTS

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 joint sealants for interior and exterior locations other than fire-resistant joints.

1.3 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that establish and maintain watertight, and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant location and material or materials receiving sealant.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color options.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

E. Qualification Data: For Installer.

F. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as described in Part 3 of this section.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

   1. Warranty Period: Two years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles or equivalent products by the following manufacturers:

   1. GE Advanced Materials
   2. Pecora Corporation
   3. Sika Corporation
   4. Tremco, Inc.
   5. BASF Building System
   6. May National Associates, Inc.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

C. Suitability for Contact with Food: Where sealants are indicated for joints that come in repeated contact with food or medicine, provide products that comply with 21 CFR 177.2600.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Nonsag Neutral-Curing Silicone Sealant ES-1

1. Joint Locations:

   a. Construction joints in cast-in-place concrete.
   b. Control and expansion joints in unit masonry.
   c. Perimeter joints between materials listed above and frames of doors, windows and louvers.
   d. Exterior perimeter joints between cast stone and unit masonry and frames of doors, entrances and storefront, windows, curtain walls, louvers, lintels and flashing.
   e. Control and expansion joints in ceilings and other overhead surfaces.
   f. Other joints as indicated.

2. Products:

   a. Dow Corning Corporation; 756 SMS*.
   b. GE Silicones; SilPruf NB 9000*.

3. Type and Grade: S (single component) and NS (nonsag).
4. Class: 50.
5. Use Related to Exposure: NT (nontraffic) joints where dirt pick-up is a concern.
6. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

   a. Use O Joint Substrates: Zinc-tin alloy coated stainless steel, field painted galvanized steel, concrete, cast stone and brick.

D. Single-Component Pourable Neutral-Curing Silicone Sealant ES-2:

1. Products:

   a. Dow Corning Corporation; 890-SL.
   b. Pecora Corporation; 300 Pavement Sealant (Self Leveling).
   c. Tremco; Spectrem Parking Structure Sealant SL.

2. Type and Grade: S (single component) and P (pourable).
3. Class: 100/50.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M and O, as applicable to joint substrates indicated.

   a. Use O Joint Substrates: Concrete.

E. Single-Component Neutral-Curing Silicone Sealant ES-3:

1. Products:

   a. Dow Corning Corporation; 790.
   b. GE Silicones; SilPruf LM SCS2700.
   c. Pecora Corporation; 890.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

   a. Use O Joint Substrates: Galvanized steel, zinc-tin alloy coated stainless steel, gypsum board coated with latex paint and covered with vinyl wall covering, direct-applied exterior insulation and finish systems, and painted steel.

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

F. Single-Component Neutral Curing Silicone Sealant ES-4:

1. Products:

   a. Dow Corning Corporation; 795.
   b. GE Silicones; SilPruf SCS2000.
   c. GE Silicones; UltraPruf II SCS2900.
   d. Pecora Corporation; 898.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

   a. Use O Joint Substrates: Gypsum board coated with acrylic paint and covered with vinyl wall covering, plastic laminate, and painted steel.

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

G. Joint-Sealant Application: Interior joints in horizontal traffic surfaces

1. Joint Locations:

   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
3. Joint Sealant: Dow Corning Corporation; 890-SL, May National Associates, Inc.; Bondaflex Sil 728 SL; Pecora Corporation; 310 SL, or Tremco Incorporated; Spectrem 900 SL.
4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

H. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces

1. Joint Sealant Location:

   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Joints between counters and adjoining walls.
   c. Tile control and expansion joints where indicated.
   d. Other joints as indicated.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

I. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces

1. For concealed or exposed locations: Manufacturer’s standard non-drying, non-hardening, non-skinning, non-staining, gunnable synthetic-rubber sealant for sealing interior concealed joints to reduce airborne sound transmission.

2. Joint Location:

   a. Acoustical joints where indicated.
   b. Joints between acoustical-panel-ceiling perimeter-trim and wall surfaces.
   c. Joints between fire-rated fire-protection cabinets and rated partitions.
   d. Other joints as indicated.

3. Joint Sealant: Acoustical Tremco® Acoustical sealant

a. Joint-Sealant Color: White.

2.4 SOLVENT-RELEASE JOINT SEALANTS

A. Butyl-Rubber-Based Solvent-Release Joint Sealant SRS-1: Comply with ASTM C 1085.

1. Joint Location:

a. Bedding compound for exterior doors, window sills and louver sills.

2. Products:

a. Bostik Findley; Bostik 300.
b. Degussa Corporation; Sonneborn® Multi-Purpose Sealant.
c. Fuller, H. B. Company; SC-0296.
d. Pecora Corporation; BC-158.
e. Polymeric Systems Inc.; PSI-301
f. Tremco; Tremco Butyl Sealant.

2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

   a. Concrete.
   b. Masonry.
   c. Cast stone.
   d. Unglazed surfaces of ceramic tile.
   e. Exterior insulation finish systems.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide recessed joint configuration of 1/4 inch (6 mm) recess depth and at slabs-on-grade per Figure 5C in ASTM C 1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
b. Perform 1 test for each 1000 feet of joint length thereafter.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, Method B, Exposed Surface Finish Hand Pull Tab, or Method C, Field-Applied Sealant Joint Hand Pull Flap in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.

4. Inspect tested joints and report on the following:
    a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    b. Whether sealants filled joint cavities and are free of voids.
    c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details, including, but not limited to, conduit and details for electrified door hardware and glazing stops.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Fleming Door Products Ltd.; an Assa Abloy Group company.
6. Habersham Metal Products Company.
7. Kewanee Corporation (The).
8. Pioneer Industries, Inc.
9. Steelcraft; an Ingersoll-Rand company.
10. Windsor Republic Doors.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B for reinforcing and other concealed locations.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating for interior doors and G90 for exterior doors.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-actuated fasteners in concrete: Not permitted.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I.

I. Glazing: Division 08 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.3 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 4 Steel Doors: 0.067-inch-(14-gage thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for existing gypsum board partitions only.
4. Frames for Level 3 Steel Doors: 0.053-inch-16-gage thick steel sheet.
5. Frames for Wood Doors: 0.053-inch-16-gage thick steel sheet.
6. Frames for Borrowed Lights: 0.053-inch-16-gage thick steel sheet.

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick to permit unobstructed grouting of frames.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, same material as door face sheet.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, same material as frames.

2.6 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.7 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

    c. Compression Type: Not less than two anchors in each jamb.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers. Provide plastic plugs to keep holes clear during construction.

    a. Single-Door Frames: Three door silencers.
    b. Double-Door Frames: Two door silencers at head jamb.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: ANSI/SDI A250.10.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Smoke-Control Doors: Install doors according to NFPA 105.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 1113

SECTION 08 1416 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches. For wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

E. Non-Fire-Rated Wood Doors: When non-fire-rated doors are indicated, provide without fire rating labels. Where labels are removed after manufacturing, finish door to remove evidence of label and its attachment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Marshfield Door Systems, Inc.
4. VT Industries Inc.
5. Mohawk Doors.

2.2 DOOR CONSTRUCTION, GENERAL

A. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf.
b. Screw Withdrawal, Edge: 400 lbf.

B. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer site. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

C. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:

a. 5-inch top-rail blocking.
b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).
2. Species: White Maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical Edges: Applied wood edges of same species as faces and covering edges of crossbands.
8. Core: Structural composite lumber.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Transparent Finish:

1. Grade: Custom.
2. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-6 catalyzed polyurethane.
3. Staining: Match Architect's sample stain color.
4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the 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

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 087100- DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood doors.

B. Hardware for fire-rated doors.

C. Lock cylinders for doors with balance of hardware specified in other sections.

D. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 081213 - Hollow Metal Frames.

C. Section 081416 - Flush Wood Doors.

D. Section 081433 - Stile and Rail Wood Doors.

E. Section 084313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BHMA A156.1 - Standard for Butts and Hinges; 2021.

C. BHMA A156.3 - Exit Devices; 2020.

D. BHMA A156.4 - Door Closers and Pivots; 2024.

E. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

F. BHMA A156.6 - Standard for Architectural Door Trim; 2021.

G. BHMA A156.7 - Template Hinge Dimensions; 2022.

H. BHMA A156.13 - Mortise Locks & Latches Series 1000; 2022.

I. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.

J. BHMA A156.22 - Standard for Gasketing; 2021.

K. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2023.

L. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

M. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

N. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.

O. DHI (KSN) - Keying Systems and Nomenclature; 2019.

P. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

Q. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

R. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

S. ITS (DIR) - Directory of Listed Products; Current Edition.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

U. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.

V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

W. UL (DIR) - Online Certifications Directory; Current Edition.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:

1. Architect.
2. Installer's Architectural Hardware Consultant (AHC).
3. Hardware Installer.
4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:

1. Architect will schedule meeting at project site prior to Contractor occupancy.
2. Attendance Required:

    a. Contractor.
    b. Owner.
    c. Architect.
    d. Installer's Architectural Hardware Consultant (AHC).
    e. Door Hardware Installer.
    f. Owner's Security Consultant.

3. Agenda:

    a. Establish keying requirements.
    b. Verify locksets and locking hardware are functionally correct for project requirements.
    c. Verify that keying and programming complies with project requirements.
    d. Establish keying submittal schedule and update requirements.

4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:

    a. Access control requirements.
    b. Key control system requirements.
    c. Schematic diagram of preliminary key system.
    d. Flow of traffic and extent of security required.

5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.

a. Submit in vertical format.

3. List groups and suffixes in proper sequence.
4. Include complete description for each door listed.
5. Include manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
6. Include account of abbreviations and symbols used in schedule.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Supplier's qualification statement.

H. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1. Include manufacturer's parts lists and templates.

I. Keying Schedule:

1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

J. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

L. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

1. Closers: Twenty five years, minimum.
2. Exit Devices: Five years, minimum.
3. Hinges: Limited lifetime, minimum.
4. Locksets: Lifetime limited, minimum.
5. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Locks: Provide a lock for each door, unless it's indicated that lock is not required.

1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.
2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
3. Strikes:

    a. Finish: To match lock or latch.
    b. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
    c. Center Strike At Pairs of Doors: 7/8 inch (22.2 mm) lip.

D. Closers:

1. Provide door closer on each exterior door, unless otherwise indicated.
2. Provide door closer on each fire-rated and smoke-rated door.
3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

E. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.

    a. Aluminum fasteners are not permitted.
    b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.

2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.

a. Self-drilling (Tek) type screws are not permitted.

3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
4. Provide wall grip inserts for hollow wall construction.
5. Fire-Resistance-Rated Applications: Comply with NFPA 80.

a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:

1. Applicable provisions of federal, state, and local codes.
2. Accessibility: ADA Standards and ICC A117.1.
3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
5. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.

1. BEST; dormakaba Group: www.bestaccess.com/#sle.
2. Hager.
3. McKinney.

B. Properties:
1. Butt Hinges: As applicable to each item specified.

a. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
b. Template screw hole locations.
c. Bearing assembly installed after plating.
d. Bearings: Concealed fully hardened bearings.
e. Bearing Shells: Shapes consistent with barrels.
f. Pins: Easily seated, non-rising pins.

1) Fully plate hinge pins.
2) Non-Removable Pins: Slotted stainless steel screws.

g. UL 10C listed for fire-resistance-rated doors.

C. Sizes: See Door Hardware Schedule.

1. Hinge Widths: As required to clear surrounding trim.

2. Sufficient size to allow 180 degree swing of door.

D. Finishes: See Door Hardware Schedule.

1. Fully polish hinges; front, back, and barrel.

E. Grades:

1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.

F. Material: Base metal as indicated for each item by BHMA material and finish designation.

G. Types:

1. Butt Hinges: Include full mortise hinges.

H. Options: As applicable to each item specified.

I. Quantities:

1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.

a. Hinge weight and size unless otherwise indicated in hardware sets:

1) For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
2) For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
3) For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
4) For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.

J. Applications: At swinging doors.

1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

K. Products:

1. Butt Hinges:

a. Concealed bearing, five (5) knuckle.

2.04 EXIT DEVICES

A. Manufacturers:

1. BEST, dormakaba Group: www.bestaccess.com/#sle.
2. Sargent.
3. Von Duprin.

B. Properties:

1. Actuation: Full-length touchpad.
2. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
3. Latch Bolts: Stainless steel deadlocking with 3/4 inch (19 mm) projection using latch bolt.
4. Lever Design: Match project standard lockset trims.
5. Cylinder: Include where cylinder dogging or locking trim is indicated.
6. Strike as recommended by manufacturer for application indicated.
7. Sound dampening on touch bar.
8. Dogging:

    a. Non-Fire-Resistance-Rated Devices: Hex key 1/4 inch (6 mm) hex key dogging.
    b. Fire-Resistance-Rated Devices: Manual dogging not permitted.

9. Touch bar assembly on wide style exit devices to have a 1/4 inch (6.3 mm) clearance to allow for vision frames.
10. All exposed exit device components to be of architectural metals and “true” architectural finishes.
11. Handing: Field-reversible.
12. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
13. Vertical Latch Assemblies' Operation: Gravity, without use of springs.

C. Grades: Complying with BHMA A156.3, Grade 1.

1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.

E. Options:

1. Exit Device Intruder Function Visual Indicator in conjunction with the ANSI “10” Function,

    a. Directional Indicator:

        1) Actuation: By a rim cylinder equipped with a keyed core or thumb-turn.
        2) Embossed into the active case cover.

    b. Large status window integrated into the housing of the exit device, with directional pointers to indicated key turn direction to lock and unlock outside lever trim.
    c. Use bright reflective materials capable of being seen in low light condition.
    d. Labels or stickers are not permitted.
    e. Impact resistant lens cover.
    f. A quarter turn (90 degrees) of key or thumb turn to lock down or unlock.
    g. Locked status indicated by a red indicator with an image of a locked padlock appearing under lens cover.
    h. Unlocked status indicated by a green indicator with an image of an unlocked padlock appearing under lens cover.

F. Products:

1. 2000.

2.05 LOCK CYLINDERS

A. Manufacturers:

1. BEST, dormakaba Group: www.bestaccess.com/#sle.
2. Substitutions: Not permitted.

B. Properties:

1. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   a. Provide cylinders from same manufacturer as locking device.
   b. Provide cams and/or tailpieces as required for locking devices.
   c. Provide cylinders with appropriate format interchangeable cores where indicated.

C. Grades:

1. Standard Security Cylinders: Comply with BHMA A156.5.

D. Material:

1. Manufacturer's standard corrosion-resistant brass alloy.

E. Types: As applicable to each item specified.

1. Standard security small format interchangeable core (SFIC) type cylinders, with seven-pin, 6C cores.

F. Applications: At locations indicated in hardware sets, and as follows

1. As required for items with locking devices provided by other sections, including at elevator controls and cabinets.

   a. When provisions for lock cylinders are referenced elsewhere in the Project Manual to this Section, provide compatible type of lock cylinder, keyed to building keying system, unless otherwise indicated.

G. Products:

1. Rim/mortise.

2.06 MORTISE LOCKS

A. Manufacturers:

1. BEST, dormakaba Group: www.bestaccess.com/#sle.
2. Substitutions: Not permitted.

B. Properties:

1. Mechanical Locks: Manufacturer's standard.

   a. Fitting modified ANSI A115.1 door preparation.
   b. Door Thickness Coordination Fitting 1-3/4 inch (44 mm) to 2-1/4 inch (57 mm) thick doors.
   c. Latch: Solid, one-piece, anti-friction, self-lubricating stainless steel.

      1) Latchbolt Throw: 3/4 inch (19 mm), minimum.

d. Auxiliary Deadlatch: One piece stainless steel, permanently lubricated.
e. Backset: 2-3/4 inch (70 mm).
f. Lever Trim:

1) Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
2) Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
3) Spindle: Designed to prevent forced entry from attacking of lever.
4) Independent spring mechanism for each lever.

(a) Trim to be self-aligning and thru-bolted.

5) Handles: Made of forged or cast brass, bronze, or stainless steel construction. Levers that contain a hollow cavity are not acceptable.
6) Levers to operate a roller bearing spindle hub mechanism.

C. Finishes: See Door Hardware Schedule.

1. Core Faces: Match finish of lockset.

D. Grades:

1. Comply with BHMA A156.13, Grade 1, Security; Grade 2.

E. Options:

1. Provide locksets made in a manufacturing facility to compliant with ISO 9001-Quality Management and ISO 14001-Environmental Management.
2. Regulatory Compliance: As required by authorities having jurisdiction the State in which the Project is located.

F. Products: Mortise locks, including standard and electrified types.

1. 40H.

2.07 CLOSERS

A. Manufacturers:

1. dormakaba; dormakaba Group: www.dormakaba.com/us-en/#sle.
2. LCN.
3. Sargent.

B. Properties:

1. Surface Mounted Closers: Manufacturer's standard.

a. Construction: R14 high silicon aluminum alloy.
b. Mechanism: Separate tamper-resistant adjusting valves for closing and latching speeds.
c. Hydraulic Fluid: All-weather type.
d. Arm Assembly: Standard for product specified.

1) Include hold-open, integral stop, or spring-loaded stop feature, as specified in Door Hardware Schedule.
2) Parallel arm to be a heavy-duty rigid arm.
3) Where “IS” or “S-IS” arms are specified in hardware sets, if manufacturer does not offer this arm provide a regular arm mount closer in conjunction with a heavy-duty overhead stop equal to a dormakaba 900 Series.

e. Covers:

1) Type: Standard for product selected.

(a) Full.

2) Material: Plastic.
3) Finish: Painted.

C. Grades:

1. Closers: Comply with BHMA A156.4, Grade 1.

a. Underwriters Laboratories Compliance:

1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.

(a) UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

D. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.

E. Types:

1. Rack-and-pinion, surface-mounted. 1-1/2 inches (38 mm) minimum bore.

F. Options:

1. Delayed action, adjustable with an independent valve.

G. Installation:

1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
3. At outswinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

H. Products:

1. Surface Mounted:

a. 8900.

2.08 PROTECTION PLATES

A. Manufacturers:

1. Trimco: www.trimcohardware.com/#sle.
2. Ives.
3. Rockwood.

B. Properties:

1. Plates:

a. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
b. Mop Plates: Provide along bottom edge of pull side of doors to provide protection from cleaning liquids and equipment damage to door surface.
c. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.

1. Metal Properties: Stainless steel.

a. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.

E. Installation:

1. Fasteners: Countersunk screw fasteners

F. Products:

1. Kick-Mop Plates.

2.09 STOPS AND HOLDERS

A. Manufacturers:

1. Trimco: www.trimcohardware.com/#sle.
2. Ives.
3. Rockwood.

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:

1. Wall Bumpers: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types:

1. Wall Bumpers: Bumper, concave, convex, wall stop.

F. Installation:

1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.

G. Products:

1. Wall Bumpers.

2.10 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:

1. National Guard Products, Inc: www.ngpinc.com/#sle.
2. Pemko.
3. Zero.

B. Properties:

1. Adhesive-Backed Perimeter Gasketing: Slilicone gasket material applied to frame with self- adhesive.

C. Grades: Comply with BHMA A156.22.

D. Products:

1. Smoke Seals: See Door Hardware Schedule.

2.11 KEYS AND CORES

A. Manufacturers:

1. BEST, dormakaba Group: www.bestaccess.com/#sle.
2. Substitutions: Not permitted.

B. Properties: Complying with guidelines of BHMA A156.28.

1. Provide small format interchangeable core.
2. Provide keying information in compliance with DHI (KSN) standards.
3. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
4. Keying: Master keyed.
5. Include construction keying and control keying with removable core cylinders.
6. Do not make brass construction cores and construction control and operating keys a part of Owner's permanent keying system, nor furnish in the same keyway (or key section) as Owner, permanent keying system.
7. Key to existing keying system.
8. Supply keys in following quantities:

    a. Master Keys: 4 each.
    b. Construction Master Keys: 6 each.
    c. Construction Keys: 15 each.
    d. Construction Control Keys: 2 each.

e. Control Keys if New System: 2 each.

9. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
10. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
11. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
12. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

C. Products:

1. Cores-Keys.

2.12 FINISHES

A. Finishes: Identified in Hardware Sets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.

1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
2. For Steel Doors and Frames: See Section 6549.
3. For Steel Door Frames: See Section 081213.
4. For Aluminum-Framed Storefront Doors and Frames: See Section 084313.
5. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
6. Flush Wood Doors: See Section 081416.
7. Stile and Rail Wood Doors: See Section 081433.
8. Mounting heights in compliance with ADA Standards:

a. Locksets: 40-5/16 inch (1024 mm).
b. Push Plates/Pull Bars: 42 inch (1067 mm).

c. Deadlocks (Deadbolts): 48 inch (1219 mm).
d. Exit Devices: 40-5/16 inch (1024 mm).
e. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).

J. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

3.04 ADJUSTING

A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

Manufacturer list

BES	Best
BES	BEST
PRE	BEST (Precision)
DKA	dormakaba Architectural
NGP	National Guard Products
TRI	Trimco

Option list

Code:	Name:
CX	Cast Wall Bumper Convex Combo Pack
D	
4	Standard Mortise
IND	Intruder Function
AF89P	Flat Form Non-Hold Open, Tri-Pack
4908	Key controls lever/knob
SDS	Extra Heavy-duty Door Saver Spring Cushion, Parallel
B4E Heavy	Heavy Bevel Edges
FL	Fire Rated Hardware
Head & Jambs (2)	Provide at the head and both jambs

VIN	Visual Indicator
CHW	CHW>COMMERCIAL HINGES
NRP	NRP>NON-REMOVABLE PINS
2	Standard Length
A	Turn Knob
10"	Height
7	7 Pin
IS	Heavy-duty Cushion, Reg./TJ 0"–3-1/2" Reveal
CSK	Counter Sunk Holes
CV	Cast Wall Bumper Concave Combo Pack
X 2" LDW	Width
45X45	4.5X4.5>
CB168	CB168>CNC BRNG FL MRT HW

Finish list

Code:	Name:
B	Brown
626	Satin Chrome plated over nickel
26D	26D>CHROMIUM PLATED SATIN
630	Satin stainless steel
689	Aluminum Painted
630	Satin Stainless Steel
626	Satin chromium plated

Hardware Sets:

Set #001 - WD UL SECURITY EXIT DEVICE
Doors: 3308/1, 3400/1, 3401/1

3.0	Hinge	CB168 NRP 45X45	26D	BES
1.0	Exit Device	FL 2110VI 4908 D	630	PRE
2.0	Rim Cylinder	12E 7 2	626	BES
1.0	Door Closer	8916 AF89P	689	DKA
1.0	Kick Plate	K0050 10" X 2" LDW CSK B4E Heavy	630	TRI
1.0	Gasketing	5050 Jambs (2)	B	NGP
1.0	Wall Stop	1270 CV CX	626	TRI
1.0	Mop Plate	KM050 4" X 1" LDW CSK B4E Heavy	630	TRI

NOTE: GC TO VERIFY EXISTING FRAME IS IN GOOD WORKING ORDER AND CODE COMPLIANT. GC IS RESPONSIBLE FOR ALL PREPS REQUIRED FOR NEW HARDWARE.

Set #002 - WD UL CLASSROOM SECURITY LOCKSET
Doors: 3403/3

3.0	Hinge	CB168 NRP 45X45	26D	BES
1.0	Mortise Lock	45H 7 IND 14 H VIN	626	BES
1.0	Door Closer	8916 SDS	689	DKA
1.0	Kick Plate	K0050 10" X 2" LDW CSK B4E Heavy	630	TRI
1.0	Gasketing	5050 Head & Jambs (2)	B	NGP
1.0	Mop Plate	KM050 4" X 1" LDW CSK B4E Heavy	630	TRI

Set #003 - WD UL CLASSROOM SECURITY LOCKSET
Doors: 3402/1, 3403/1, 3403/2, 3404/1, 3404/2

3.0	Hinge	CB168 45X45	26D	BES
1.0	Mortise Lock	45H 7 IND 14 H VIN	626	BES
1.0	Door Closer	8916 IS	689	DKA
1.0	Kick Plate	K0050 10" X 2" LDW CSK B4E Heavy	630	TRI
1.0	Gasketing	5050 Head & Jambs (2)	B	NGP
1.0	Mop Plate	KM050 4" X 1" LDW CSK B4E Heavy	630	TRI

NOTE: AT EXISTING FRAMES TO REMAIN - GC TO VERIFY EXISTING FRAME IS IN GOOD WORKING ORDER AND CODE COMPLIANT. GC IS RESPONSIBLE FOR ALL PREPS REQUIRED FOR NEW HARDWARE.

Set #004 - EXISTING OPENING ALL HARDWARE TO REMAIN.
Doors: 3401/2

NOTE: GC TO VERIFY EXISTING DOOR AND FRAME ARE IN GOOD WORKING ORDER AND CODE COMPLIANT.

END OF SECTION 08 7100

SECTION 08 8813 - FIRE-RESISTANT GLAZING

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. Fire-protection-rated glazing.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

B. Product Certificates: For each type of glass and glazing product, from manufacturer.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. Manufacturer's Standard Warranty on Laminated Ceramic Glass:

1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer’s Standard Warranty on Fire-Protection-Rated Tempered Glass:

1. Warranty Period: Lifetime Warranty from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Glazing Manual."

B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.

C. Fire-Protection-Rated Tempered Glass: 1/4” thickness, fire-protection-rated tempered glass; and complying with 16 CFR 1201, Category II.

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. InterEdge; PyroEdge-20.
b. Safti First; SuperLite I.
c. Technical Glass Products; Fireglass20.
d. Vetrotech Saint-Gobain; SSG Pyroswiss US.

D. Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 5/16” total thickness; and complying with 16 CFR 1201, Category II.

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. Interedge Technologies; Pyran Platinum L.
b. Safti First; Pyran Platinum L
c. Schott North America, Inc.; Pyran Platinum L.
d. Technical Glass Products; FireLite Plus.
e. Vetrotech Saint-Gobain; SGG Keralite FR-L.

2.5 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

C. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 FIRE-RESISTANT GLAZING SCHEDULE

A. Glass Type G-1: 90-minute fire-protection-rated glazing; laminated ceramic glazing.

END OF SECTION 08 8813

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing systems for interior gypsum board assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, indicating metal thicknesses for each size. Where dimpled studs are submitted, provide evidence that the products are evaluated and accepted by the ICC-ES according to ES ESR-1977, *UltraSTEEL Wall Studs and Tracks (Nonload-Bearing*). Provide data indicating each stud's equivalency to specified minimum base-metal thickness.

B. Framing Details for each type of opening.

C. Floor plans marked with size and spacing of studs used in framed partitions, indication of whether walls continue to underside of structure, and whether or not the partition is fire-rated.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Framing members must have a protective coating conforming to Specification A 653/A 653M – G40 hot dipped galvanized minimum or shall have a protective coating with an equivalent corrosion resistance.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413.

2.3 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Studs and Runners: ASTM C 645 Specification for Nonstructural Steel Framing Members and C 754 Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products. Use either steel studs and runners or dimpled steel studs and runners of demonstrated equivalent minimum base-metal thickness.

1. Minimum Base-Metal Thicknesses:

   a. For Door Opening Framing for up to 2'-8" wide doors weighing 100 lbs. or less: 0.018 inch (25-gage).
   b. For non-fire-rated solid-core doors up to 200 lbs: 0.033 inch (20-gage).
   c. For fire-rated door frames: 0.033 inch (20-gage)
   d. For doors up to 4'-0" wide or doors up to 300 lbs.: Nested or double studs of 0.033 inch (20-gage) minimum.
   e. For pairs of doors, follow ASTM C 754.
   f. For framing supporting cementitious backer board and ceramic tile: 0.043 inch (18-gage).
   g. For ceramic tile on gypsum board backing: 0.033 inch (20-gage).
   h. For standard partitions with 5/8" gypsum wallboard on each side, with a maximum deflection of L/240, do not exceed the height limitations of ASTM C 754 or the steel stud manufacturer's requirements.

2. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following in thickness not less than indicated for studs and in width to accommodate depth of studs:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
      2) MBA Building Supplies; FlatSteel Deflection Track, Slotted Deflecto Track.
      3) Steel Network Inc. (The); VertiClip SLD, VertiTrack VTD Series.
      4) Superior Metal Trim; Superior Flex Track System (SFT).
      5) Telling Industries; Vertical Slip Track, Vertical Slip Track II.

D. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
   b. Grace Construction Products; FlameSafe FlowTrak System.
   c. Metal-Lite, Inc.; The System.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.027 inch (22-gage).

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch (16-gage) minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch (20-gage.
2. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

I. Cold-Rolled Furring Channels: 0.053-inch (16-gage) uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (20-gage.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch (25-gage), and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide asphalt saturated organic felt or foam gasket.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings or to some specified height above the finished ceiling. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure. Install diagonal bracing from door head and jamb framing to structure on both sides of partition for doors over 36" wide.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, with foam or felt separation between studs and masonry.

F. Z-Furring Members:

1. Erect rigid insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 2216

SECTION 09 2900 – INTERIOR GYPSUM BOARD

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. Interior gypsum board.
2. Tile backing panels for interior walls.
3. Accessories.
4. Sound Attenuation Blankets.
5. Acoustical Sealants.

1.3 DEFINITIONS

A. Below Grade Wall: The opposite side of the wall is backfilled, unexcavated, or a crawl space.

B. Critical Lighting: Natural or artificial lighting that makes gypsum board joint treatments detectable. Room finish schedule identifies walls and ceilings affected by critical lighting.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Plan: Indicate location of each type of gypsum wallboard or backerboard using material designation in Part 2 of this Section. Where a UL rated assembly is required, indicate compliance with the product listed in that assembly.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying 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 GYPSUM BOARD, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Location for each type: Location for use of each type is included below or is included in the requirements for fire-rated assemblies.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Application: Use for all exposed vertical surfaces except areas receiving ceramic or porcelain tile.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

2.4 TILE BACKING PANELS

A. Glass-Mat, Mold and Water-Resistant Tile Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Application: Use behind ceramic or porcelain wall tile except in shower stalls.
2. 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.; GlasRoc® Tile Backer
    b. Georgia-Pacific Gypsum LLC; DensShield® Tile Backer.

3. Core: 5/8" type X.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer. Must be mold-resistant.
2. Cementitious Backer Units: As recommended by backer unit manufacturer. Must be mold resistant.
3. Products: Provide one of the following or other as recommended by the panel manufacturer:

    a. National Gypsum Company: ProForm XP.
    b. CTS Cement Manufacturing: Rapid Set.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating 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. Laminating 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. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
    b. Grabber Construction Products; Acoustical Sealant GSC.
    c. Pecora Corporation; AIS-919. Use AC-20 FTR in fire-rated partitions.
    d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
    e. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing) as recommended by panel manufacturer for each condition, or unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws where required by fire-resistance rated assembly and unless indicated otherwise. Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners where directed by Architect.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
3. Fasten with corrosion-resistant screws.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 above both sides of doorways, in specific locations approved by Architect for visual effect and so no joints are farther apart than 30 feet, and where new and existing partitions align in place.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where gypsum board abuts other materials.
5. U-Bead: Use at exposed edges.
6. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile or acoustical tile.
3. Level 3: Not used.
4. Level 4: At all locations where exposed to view and finished with flat, semi-gloss or gloss paints.
5. Level 5: Not used.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 5113 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical mineral fiber and metal panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: One 6-inch-square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: One 6-inch-long Samples of each type, finish, and color.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components (panel name and grid type).
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Projectors and/or television mounts.
    g. Roller shade ceiling mounts.

5. Perimeter moldings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 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. Acoustical Ceiling Panels: Full-size panels equal to two percent of quantity installed, but no less than 2 full boxes of each type of panel used on the Project.
2. Suspension-System Components: Quantity of each exposed component equal to two percent of quantity installed.
3. Retention Clips: Equal two (2) percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD 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. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 for Seismic zones 0-2.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Twenty-Five (25) or less. Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: Fifty (50) or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings 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. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type as shown on Drawings.

F. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM G 21.

2.3 ACOUSTICAL PANEL PRODUCTS

A. Refer to Drawings for the Basis-of-Design acoustical Lay-In Ceiling Panels, edge conditions and Suspension Systems.

B. Refer to Reflected Ceiling Drawings for representation of grid dimension.

C. Subject to compliance with requirements, provide Basis-of-Design products indicated on the Drawings manufactured by **Armstrong World Industries, Inc**., or comparable products manufactured by the following:

1. USG Interiors, Inc.
2. CertainTeed Architectural

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five (5) times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

    a. Type: Cast-in-place anchors or post-installed threaded anchors.
    b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.

2. Power-Actuated Fasteners in Concrete: Not Permitted

C. 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/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch diameter wire.

D. Hold-Down or Retention Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturer of the suspension system.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, suspension system manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements;

formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. 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.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
4. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
5. For ceiling systems adjacent to masonry walls, provide stepped edge molding that forms 3/4- by 3/4-inch (19- by 19-mm) reveal at masonry.

2.6 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
   b. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

   a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
   b. Pecora Corporation; AIS-919.
   c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and 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.

1. Exposed and Concealed Joints: Non-sag, paintable, non-staining latex sealant.
2. Concealed Joints: Nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant.
3. Acoustical sealants shall comply with the VOC limits for this product used within the Commonwealth of Pennsylvania.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or 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, post-installed mechanical or adhesive anchors.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel roof deck by piercing the deck or to steel deck tabs. Attach hangers to structural members.
9. Space hangers a maximum of 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support light fixtures, access panels, speakers and other ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. 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 o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

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 edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Install hold down or impact clips in areas indicated. Space as recommended by panel manufacturer's written instructions unless otherwise indicated.
6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 6513 - RESILIENT 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Resilient cove base.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products 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 For more than 90 deg F.

1.5 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg For more than 95 deg F, 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. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT COVE WALL BASE

A. Basis-of-Design Products:

1. Johnsonite/Tarkett Traditional Cove 4”

2. Color: Charcoal

3. Outside corners: Premolded.

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 resilient product manufacturers for applications indicated. Compressive strength not less than 4,000 psi (27.6 MPa) at 28 days.

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, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. 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 resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended sealant or adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3. Shaped Outside Corners: Use straight pieces of maximum lengths possible. Cut each piece at an angle equal to half the angle of the junction. Apply adhesive to the back of the pieces, position in place with the joint interface closed along its entire length. Roll each side with a hand roller toward the joint.
4. Shaped Inside Corners: Use straight pieces of maximum lengths possible. Cut the first piece to fit tightly to the face of the adjacent wall. Apply adhesive to the back of the piece, position in place with the cut end closed to the adjacent wall. Roll with a hand roller toward the adjacent wall. Cut the end of the second piece to the profile of the first piece creating a coped or scribed joint. Apply adhesive to the back of the second piece, position in place with the scribed end closed to the first piece. Roll with a hand roller toward the first piece.

H. Running Joints: Use straight pieces of maximum lengths possible. Cut each piece at an angle so the total of the 2 angles equals 180 deg. Apply adhesive to the back of the piece with the open cut, position it in place and roll it with a hand roller. Apply adhesive to the back of the piece with the closed cut, position it in place over the cut of the first piece to form a hairline joint in the face of the base. Roll the second piece with a hand roller toward the joint.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product 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.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09 6513

SECTION 09 6519 - RESILIENT TILE FLOORING

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 the following:

1. Rubber Floor Tile

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of flooring type, include floor pattern layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, seaming diagrams and cutouts.

1. Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

D. Product Schedule: For floor tile. Use same designations and room names and numbers as indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MATERIALS MAINTENANCE 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. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

1. Installer Qualifications: Acceptable to manufacturer of resilient flooring or INSTALL (International Standards & Training Alliance) resilient certified for the requirements of the project with a minimum of 4 years'

experience with resilient flooring of type equivalent to those specifiedEngage 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.

1.8 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 or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, 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 or more than 95 deg F.

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.

F. Concrete Curing: Do not install flooring over concrete substrates until substrates have cured and are dry to bond with adhesive as determined by resilient flooring manufacturer's recommended bond, moisture test, and pH test.

PART 2 - PRODUCTS

2.1 Rubber Floor Tile

A. Basis-of-Design Product: Nora Systems, Inc.

B. Collection Noraplan Environcare 3.0mm, Article 2463

C. Size: 24.015 inches by 24.015 inches (610mm by 610mm)

D. Color: 7037 Fun Run

E. Surface: Smooth

F. Back of Tile: Souble-sanded smooth

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.

C. Floor Polish: Provide protective liquid floor polish and wax 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 relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

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 orthogonal with walls.

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.

1. Lay tiles in monolithic direction unless noted otherwise.

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, no staining 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.

I. Roll floor in both directions with a 100lb. 3-section roller. Roll again an hour later. Inspect floor 2-1/2 hours later and roll again if necessary. Remove any adhesive from between seams.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

1. Wait 72 hours after installation before initial cleaning.

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.
4. Do not use mechanical polishers which exceed 350 RPM.

C. Protect flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover sheet linoleum until Substantial Completion.

END OF SECTION 09 6519

SECTION 09 9123 - PAINTING

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 surface preparation and the application of paint systems on the following substrates:

1. Concrete masonry units (CMU).
2. Steel.
3. Galvanized metal.
4. Gypsum board / Plaster.

1.3 DEFINITIONS

A. Definitions of gloss levels below are from "MPI Architectural Painting Specification Manual"

1. Gloss Level 1: (Flat, Matte) Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
2. Gloss Level 2: (Flat, Velvet-like) Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
3. Gloss Level 3: (Eggshell) 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
4. Gloss Level 4: (Satin) 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
5. Gloss Level 5: (Semi-Gloss) 35 to 70 units at 60 degrees, according to ASTM D 523.
6. Gloss Level 6: (Gloss) 70 to 85 units at 60 degrees, according to ASTM D 523.

B. MPI: Master Painters Institute.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Provide a schedule of each paint system for each substrate listing primer, intermediate and top coat, along with level of gloss and sheen and VOC content.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each color and gloss of topcoat.

1. Submit Samples, 8 inches square minimum.
2. Label each Sample for location and application area.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: Provide 1 quart of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Sherwin Williams Company (The).
2. PPG Architectural Finishes, Inc.
3. Benjamin Moore & Co.
4. Pratte & Lambert.
5. Tnemec.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction[and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

C. Colors: As indicated on Drawings.

2.3 PROFILERS FOR GALVANIZED METAL

A. Cleaner, Etching, for Galvanized Metal:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. PPG Architectural Finishes, Inc.; Greensolv, G-Clean, 307
    b. Sherwin Williams Great Lakes Laboratories Clean ‘n Etch, 899.

2.4 BLOCK FILLERS FOR NEW CONCRETE BLOCK

A. Block Filler, Latex, Interior/Exterior.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Benjamin Moore & Co.; Moorcraft, Super Craft Latex Block Filler, 285-01.
    b. Benjamin Moore & Co.; Moorspec, Int/Ext Latex Block Filler, 59501.
    c. PPG Architectural Finishes, Inc.; Speedhide, Int/Ext Masonry Block Filler, 6-15.
    d. Sherwin-Williams Company (The); PrepRite, Int/Ext Block Filler, B25W25.

2.5 PRIMERS/SEALERS

A. Primer for previously painted Concrete Block:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. PPG: Bonding Primer “Seal Grip” Acrylic Universal Primer 17-921.

B. Primer Sealer, Latex, Interior, for Gypsum Wallboard Ceilings and Walls.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Benjamin Moore & Co.; Regal, First Coat Latex Primer/Undercoater, 216.
    b. PPG Architectural Finishes, Inc.; Speedhide, Int. Latex Primer Sealer, 6-2 or Pure Performance Interior Latex Primer 9-900.
    c. Sherwin-Williams Company (The); Quali-Kote, Interior Latex Primer, B28WB1; B28WQ8001 or Harmony Interior Latex Primer B11W00900.

C. Primer for Interior Galvanized Metal (after cleaning and etching): Not for use on factory-primed galvanized metal.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. PPG: Interior/Exterior WB Industrial Primer 90-912.
b. Sherwin Williams Pro-Industrial Pro-Cryl Universal Primer B66W310.
c. Benjamin Moore: Super Spec HP Acrylic Metal Primer P04/KP04.

D. Rust Inhibitive Primer, for Interior or Exterior Ferrous Metals.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. PPG: Pitt-Tech Plus Int/Ext DTM Industrial Primer 90-909 (gray) or 90-912 (white).
b. Sherwin Williams: ProIndustrial Pro Universal Primer B66W310.

E. Primer for Thermoplastic Dimension Ceiling (after cleaning and prepping per manufacturer's recommendation).
1. Sherwin Williams: DTM Bonding Primer
2. Benjamin Moore: Fresh Start Primer

2.6 WATER-BASED INTERMEDIATE AND TOP COATS

A. General: The gloss level of paints is determined by the schedule at end of Section. All surfaces are to have a filler and/or primer/sealer, an intermediate coat and a top coat, except for Dry Fall paints.

B. Latex, Interior, Flat, (Gloss Level 1 or 2): For ceilings on Gypsum Wallboard except in janitor's closets and restrooms.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. PPG Speedhide 6-70 Interior Latex Flat (for ceilings).

C. High Performance Architectural Latex, Interior, Eggshell/Satin (Gloss Level 3): For walls on gypsum wallboard and concrete masonry units.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. PPG Manor Hall Interior 100% Acrylic Latex-Eggshell 83-310.
b. Sherwin Williams Eminence HP Interior Low-Lustre Eg-Shel D17WQ8851.

2. Water-Based Epoxy Coating System (MPI INT 9.2F Premium Grade):

a. Prime Coat PPG Architectural Finishes, Inc.; Speedhide, Int. Latex Primer Sealer, 6-2.
b. Intermediate Coat: Aquapon, Waterborne Epoxy, 98-1.
c. Topcoat: Aquapon, Waterborne Epoxy, 98-1.

D. Latex, Interior, Semi-Gloss, (Gloss Level 5): Ferrous Metal Doors, Frames, Borrowed Lights frames, handrails.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. PPG Architectural Finishes, Inc.; Speedhide, Interior Enamel Latex Semi-Gloss 9-6500.

E. Interior Acrylic Latex in Flat: Thermoplastic Dimension Ceilings

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Sherwin Williams Super Paint or Duration or Similar.
   b. Sherwin Williams Polane Series of Similar
   c. Cardinal: Polyurethane 6400 Series

2.7 URETHANE BASED COATINGS

A. Urethane based, Semi-Gloss (Gloss Level 5) for exterior galvanized steel doors, frames, lintels:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:

   a. PPG Pitthane High Build Semi-Gloss Urethane 95-8800.

2.8 DRY FOG/FALL COATINGS

A. Dry Fall, Latex, Flat (Gloss Level 1 or 2), for Factory-Primed Galvanized Metal:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. PPG Speedhide SuperTech WB Interior Dry Fog Flat Latex 6-715XI.

B. Dry Fall, Water Based, for Cleaned/Etched Galvanized Steel, Flat (Gloss Level 1 or 2) at exposed ducts where indicated.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. PPG Speedhide SuperTech WB Interior Dry Fog Flat Latex 6-675XI.
   b. Benjamin Moore: Super Spec Sweep Up Spray Latex Flat 153/K153.
   c. Sherwin Williams: Pro Industrial Waterborne Acrylic Dryfall Flat, B42-80 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (Clay and CMU): 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. Where material is factory-primed, contractor is to verify that the finish coats are compatible with the factory-primed surface.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

B. Use applicators and techniques suited for paint and substrate indicated.

1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
2. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

   a. Equipment, including panelboards.
   b. Pipe hangers and supports.
   c. Metal conduit.
   d. Tanks that do not have factory-applied final finishes.

2. Paint the following work where exposed in occupied spaces:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Pipe hangers and supports.
   d. Metal conduit.
   e. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces. Paint black color.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. Paint scrapings, used paint filters, rags and other materials wetted or saturated with products that have the potential to spontaneously combust according to NFPA Handbook or manufacturer’s product data, should not be left unattended. Clean up and properly dispose of these materials promptly at the end of each work day. To dispose of these materials properly, thoroughly wet the contaminated materials with water and place them in a noncombustible container with a tight-fitting lid, or place them in a water-filled metal container in accordance with NFPA 33 Standard, 2007.

C. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 GLOSS SCHEDULE

A. For intermediate and topcoats, the required gloss levels are as follows unless noted otherwise on the Drawings:

1. Gypsum Board Ceilings: Flat.
2. Gypsum Board Walls: Eggshell / Satin.

3. Concrete Block: Eggshell / Satin.
4. Metal Doors, Frames, Borrowed Light Frames (interior): Semi-Gloss.

END OF SECTION 09 9123

SECTION 10 1100 - VISUAL DISPLAY SURFACES

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. Markerboards.
2. Tackboards and Tackstrips-Aluminum Framed.
3. Horizontal-Sliding Markerboard Units
4. Accessories

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

1. Include rated capacities, operating characteristics and individual panel weights for sliding visual display units.

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work for each type of item.

1. Show locations of panel joints.
2. Include sections of typical trim members.
3. Show locations of special-purpose graphics for visual display surfaces.

C. Samples for Verification: For each type of visual display surface indicated.

1. Visual Display Surface: Not less than 6 x 6 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch-long sections of each trim profile.
3. Support System: Clips or 6-inch-long sections.
4. Accessories: Full-size Sample of each type of accessory.

D. Product Schedule: For visual display surfaces, using same room and item designations as used on Drawings. Indicate size of each item and include color and finish selection for each item, including frames.

E. Sample Warranty for each product.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display surfaces units to include in maintenance manuals.

B. Manufacturers' Warranties for each type of product.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surfaces from a single fabricator or manufacturer.

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: 450 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, pre-fit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

C. Framed wall stud spacing will be 16” on center unless noted otherwise.

1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Minimum 50 (fifty) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel.

1. Material Manufacturers: Subject to compliance with requirements, provide products by one of the following

a. Claridge Products and Equipment, Inc.
b. PolyVision Corporation; a Steelcase company.
c. AARCO Visual Display Products.

B. Fabricators:

1. Fabricators may be the material manufacturer or certified fabricators approved by the material manufacturer.

C. Gloss Finish: Low gloss; dry-erase markers wipe clean with dry cloth or standard eraser. Suitable for use as projection screen.

D. Bulletin Board: Homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing. The uni-color extends throughout the thickness of the material.

E. Particleboard: ANSI A208.1, Grade M-1 made with binder containing no urea formaldehyde that complies 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."

F. Fiberboard: ASTM C 208.

G. Extruded Aluminum: ASTM B 221, Alloy 6063.

H. Adhesives: Manufacturer's standard product that complies 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 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch-thick porcelain-enamel face sheet with low gloss finish.

1. Manufacturers and Fabricators: Subject to compliance with requirements, provide products by one of the following:

a. Claridge Products and Equipment, Inc.
b. PolyVision Corporation; a Steelcase company.
c. AARCO Visual Display Products.

2. Particleboard Core: 3/8 or 7/16 inch thick, urea formaldehyde free; with 0.005-inch-thick, aluminum foil backing.
3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 MARKERBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; 5/8” exposed clear anodized aluminum.

1. Factory-Applied Trim: Manufacturer's standard.

B. Magnetic Accessory tray.

1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
2. Size 2-3/4” inches deep by 24” long.

3. Finish: Satin anodized aluminum.

2.4 HORIZONTAL-SLIDING MARKERBOARD UNITS

A. Horizontal-Sliding Markerboard Units: Field-fabricated units consisting of aluminum-framed horizontal-sliding panels, and extruded-aluminum fascia that conceals overhead sliding track; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.

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. A-1 Visual Systems.
   b. AARCO Products, Inc.
   c. ADP Lemco, Inc.
   d. Aywon
   e. Best-Rite Manufacturing
   f. Claridge Products and Equipment, Inc.
   g. PolyVision Corporation; a Steelcase company.
   h. Tri-Best Visual Display Products.

2. Three-Track Units: Provide three sliding panels, each equal to not less than one-third of overall length of unit.

3. Sliding Panels: Fabricated from not less than 3/8" thick, kraft-paper honeycomb core: designed to be rigid and to resist warpage.

   a. Fabricate sliding panels with 0.021-inch uncoated thickness, porcelain-enamel face sheets.

4. Hardware: Manufacturer's standard, extruded-aluminum overhead track and channel-shaped bottom guides; with two nylon ball-bearing carriers and two nylon rollers for each sliding panel.

2.5 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length or access to the space would not be possible with a single unit. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint spline system between abutting sections of chalkboards or markerboards.
3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 GENERAL FINISH REQUIREMENTS

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: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.8 VISUAL DISPLAY SURFACE SCHEDULE

A. Markerboard: Porcelain-enamel markerboard assembly.

1. Color: White.
2. Style: As indicated on Drawings.
3. Corners: Square.
4. Width: As indicated on Drawings.
5. Height: As indicated on Drawings.
6. Mounting: Wall clips.
7. Mounting Height: As indicated on Drawings.
8. Factory-Applied Aluminum Trim: Manufacturer's standard aluminum, 5/8” wide with clear anodic finish.
9. Accessories:

    a. Marker tray: Magnetic Accessory tray.

B. Visual Display Wall Panels: Consisting of the following visual display surface:

1. Marker Wall Panel: Porcelain-enamel markerboard assembly

    a. Panel-joint edges: Precision formed on all four sides, frameless finish edge system.
    b. Color: White
    c. Mounting system: Cleat-Bar wall mounting system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display surfaces.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

D. Prepare recesses for visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or as indicated above. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 1100

SECTION 10 1400 - SIGNAGE

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 the following:

1. Panel signs, interior mounted.

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 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide outdoor message display signage capable of withstanding the effects of gravity loads and stresses within limits and under conditions indicated, determined according to ASCE 7, “Minimum Design Loads for Buildings and Other Structures”.

1.5 ACTION 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 domed Grade 2 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 for each color required.
2. Panel Signs: Not less than 12 inches square including specified edge and corner.

E. Sign Schedule: Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Warranty: Manufacturer's Standard Warranty for type of product.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

B. Executed Warranty.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.11 WARRANTY

A. 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:

    a. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: For panel signs, lifetime of building.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

2.2 PANEL SIGNS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Vivid B.8 V1AB07, by Takeform, Inc.** or a comparable product by one of the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. Allen Industries Architectural Signage
4. Allenite Signs; Allen Marking Products, Inc.
5. APCO Graphics, Inc.
6. ASI Signage Systems, Inc.
7. Bunting Graphics, Inc.
8. Innerface Sign Systems, Inc.
9. InPro Corporation
10. Matthews International Corporation; Bronze Division.
11. Mills Manufacturing Company.
12. Mohawk Sign Systems.
13. Seton Identification Products.

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 inchmeasured diagonally from corner to corner, complying with the following requirements:

1. Acrylic Sheet: 1/4 inch thick.
2. Edge Condition: Square Cut
3. Corner Condition in Elevation: Square
4. Mounting: Surface mounted to wall with adhesive
5. Surface Texture: Matte.
6. Colors: As selected by Architect from manufacturer's full range.
7. Text and Typeface: As selected by Architect from manufacturer's full range.
8. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

C. Changeable Message Inserts: Where shown on Drawings, fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.

1. Furnish insert material and software for creating text and symbols for PC-Windows or Apple computers for Owner production of paper inserts.
2. Furnish insert material cut-to-size for changeable message insert.

D. 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: Clear acrylic sheet with opaque color coating, subsurface applied.
2. Raised-Copy Thickness: Not less than 1/32 inch.

E. 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 are UV and water resistant.

1. Colors: As selected by Architect from manufacturer's full range.

F. Panel Sign Schedule:

1. Sign Types: See Drawings.

2.3 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.

2.4 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.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated by Architect in field, 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 of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except as noted otherwise.

1. Where backup panel is required.
2. Shim Plate Mounting: Provide 1/8-inch-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. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through counter-sunk predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
4. Signs Mounted on Glass: Provide matching opaque plate lined up with sign on opposite side of glass to conceal mounting materials. Adhere to glass and seal edge with sealant.

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 10 1400

SECTION 10 4416 – FIRE EXTINGUISHERS AND CABINETS

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 the following:

1. Portable fire extinguishers, mounted directly to wall.
2. Portable fire extinguishers and cabinets – non-rated and rated.
3. Fire Blankets with Cases.

1.3 DESIGN REQUIREMENTS

A. Access for Persons with Disabilities: In addition to local governing regulations, follow Pennsylvania Code, title 34, labor and Industry Chapter 60 Universal Accessibility Standards and ADA, including ADA Accessibility Guidelines.

1. Design fire extinguishers, cabinets, and hardware so they do not protrude more than 4 inches into walks, halls, corridors, passageways, or aisles.

1.4 SUBMITTALS

A. Product Data: Manufacturer's product data, including operating instructions.

1. Fire Extinguishers: Include rating and classification.
2. Mounting brackets.
3. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style. Indicate which cabinets are rated for 1 or 2 hour construction.
4. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

C. Warranty.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

D. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209.
2. Extruded Shapes: ASTM B 221.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

2.3 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers: Subject to compliance with requirements, provide extinguishers by the following manufacturers:

1. Fire End & Croker Corporation.
2. J.L. Industries, Inc., a division of Activar Construction Products Group.
3. Larsen's Manufacturing Company.
4. Kidde.
5. Modern Metal Products; Div. of Technico.
6. Moon American.

B. General: Provide fire extinguishers of type, size, and capacity specified.

1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A: 60-B: C, 10-lb nominal capacity, with mono-ammonium phosphate-based dry chemical in enameled-steel container.

1. Application: All locations except where noted otherwise.

2.4 MOUNTING BRACKET

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or colored baked-enamel finish.

2.5 FIRE PROTECTION CABINET

A. Manufacturers: Subject to compliance with requirements, provide cabinets by one of the following:

1. Fire End & Croker Corporation.
2. J.L. Industries, Inc., a division of Activar Construction Products Group.
3. Samson, a division of Activar Construction Products Group.
4. Larsen's Manufacturing Company.
5. Kidde.
6. Modern Metal Products; Div. of Technico.
7. Potter Roemer LLC.
8. Moon American.

B. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.

1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
2. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Construction: Non-rated, 1-hour rated or 2 hour rated as shown by location on Drawings.

D. Door Material: Stainless Steel or Extruded-aluminum shapes.

E. Door Style: Full bubble with frame.

F. Door Glazing: Molded acrylic bubble.

1. Acrylic Bubble Color: Clear, transparent.

G. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide Projecting door pull and friction latch
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

H. Finishes:

1. Manufacturer's standard baked-enamel or powder-coat paint for the interior of cabinet.
2. Clear anodic aluminum or #4 Satin Stainless Steel for cabinet door frame and trim.

2.6 FIRE BLANKET WITH CASE

A. Basis-of-Design Product: Subject to compliance with requirements, provide, **Flinn Scientific, Fire Blanket with Case, Catalog # SE3006** or comparable product by another manufacturer.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: White Gloss.

2.8 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged for security fire protection cabinets.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.9 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable mounting location and blocking.

B. Prepare recesses for fire protection cabinets and AED units as required by type and size of cabinet and trim style.

C. Install rated cabinets in rated partitions.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Locate cabinets in locations shown on Drawings in the type of Cabinet and with the type of Extinguisher identified.
2. Height of Extinguishers: 48 inches above finished floor to handle of extinguisher.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Extinguishers must be inspected and tagged with date of inspection prior to Substantial Completion.

END OF SECTION 10 4416

SECTION 10 5613 – CANTILEVER METAL STORAGE SYSTEM

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 the following:

1. Cantilever metal storage system.

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM A240 / A240M – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

2. ASTM A653 / A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM A1008 / A1008M – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

4. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

5. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

6. ASTM D522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.

7. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

8. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test.

B. Federal Specifications (Fed Spec):

1. Fed Spec AA-S-1048 – Shelving, Storage, and Display, Steel, Clip Type.

C. Military Specifications (MIL):

1. MIL S-5059 – Steel, Corrosion-Resistant (18-8), Plate, Sheet Strip.

D. Society of Automotive Engineers (SAE):

1. SAE AMS-QQ-A250/2 – Aluminum Alloy 3003, Plate and Sheet.

1.4 SUBMITTALS

A. Comply with Section 01 3300 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including list of components, quantities to be provided, and installation instructions

C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finish, options, accessories, and layout of system.

D. Samples: Submit manufacturer's samples:

1. 6-inch minimum length of upright.
2. Shelf support bracket with clamp assembly.
3. 6-inch minimum width of shelf in selected finish.

E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

F. Cleaning Instructions: Submit manufacturer's cleaning instructions.

G. Warranty Documentation: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm specializing in manufacture of cantilever metal shelving systems with 25 years minimum successful experience.

B. Sole Source Responsibility: Shelving system components shall be products from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Store materials in clean, dry area indoors.
4. Do not store materials directly on floor.
5. Store materials on flat, level surface, raised above floor, with adequate support to prevent sagging.
6. Protect materials and finish during storage, handling, and installation to prevent damage

1.7 WARRANTY

A. Warranty Period: 10 years for properly installed storage system to cover repair or replacement of defective or structurally failed components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide cantilevered metal storage system manufactured by E-Z Shelving Systems, Inc:

1. E-Z Shelving Systems, Inc.; 5633 Merriam Drive, Merriam, Kansas 66203; Telephone:800-353-1331

B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01 2500 – Substitution Procedures.

2.2 PERFORMANCE REQUIREMENTS

A. Cantilever Metal Storage System: Design, fabricate, and install such that:

1. Shelves are cantilevered without front supports, providing completely open, full width, useable shelves.
2. Shelf lengths are provided to completely fit layout indicated on Drawings without voids, gaps, or wasted space.
3. Shelves may be positioned at any height above base bracket.
4. Systems with slots or holes that dictate shelf heights: Not acceptable.
5. Storage system shall be expandable using additional modular components.
6. Storage system can be dissembled and re-erected in different location or configuration.
7. Loading capacities for 36 inches shelf span:

    a. Shelf Uniform Load:
        1) 24 inches deep shelf: 120 psf

    b. Shelf Concentrated Load: 450 lbs

    c. Loading Capacity for Single Shelf Bracket:
        1) 24 inches long bracket: 395 lbs

    d. Loading Capacity for Double Shelf Bracket::
        1) 24 inches long bracket: 198 lbs

2.3 STORAGE SHELVING SYSTEM

A. Provide complete, cantilever shelving system consisting of modular shelves, uprights, shelf brackets, clamp assemblies, fasteners, and other components and accessories that can be field assembled; E-Z Shelving System as manufactured by E-Z Shelving Systems, Inc.

B. Compliance: System shall comply with Fed Spec AA-S-1048, Kind I, Class 2, Type 7D.

C. Layout: Dimensions, number of tiers, location, spacing, and details shall be as indicated on Drawings and approved shop drawings.

D. Mounting Method: Shelving shall be supported on cantilevered brackets attached to wall mounted uprights.

2.4 SOLID LOUVERED SHELVES

A. Type A: Solid surface, powder paint coated, steel shelves; EZPS as manufactured by E-Z Shelving Systems, Inc.

1. Material: 16 gauge steel sheet complying with ASTM A1008 phosphate primed and finished with electrostatically applied plastic powder resin paint coating with these characteristics:

   a. Hardness: 2H tested in accordance with ASTM D3363.
   b. Flexibility: Passes 1/8-inch conical mandrel tested in accordance with ASTM D522.
   c. Impact Resistance: 160/160 direct and reverse tested in accordance with ASTM D2794.
   d. Tensile Strength: 5,300 psi
   e. Elongation: 3 percent
   f. Color: As selected by Architect from manufacturer's full range.

2. Profile: Form shelf from single sheet with front edge bent down and back edge bent up to provide rigidity. Provide front and back flanges with return so that cut edges are not exposed. Shelves shall have no unsanitary hems, crevices, or folds:

3. Pre-punch shelves for attachment to brackets. Provide with screws and wingnuts for attachment.

4. Size: As indicated on drawings.

2.5 UPRIGHTS

A. Types: Provide the following uprights as required for shelving layout indicated on Drawings.

1. Type A: Wall-mounted upright with slotted tubular face to receive shelf brackets and double flange on backside for attachment to substrate. Flanges shall be punched with 1/4 inch diameter mounting holes starting 2 inches from each end.

B. Material:

1. Powder Paint Coated Steel: 14 gauge steel sheet complying with ASTM A1008 phosphate primed and finished with electrostatically applied plastic powder resin paint. Finish and color to match shelves.

2.6 BRACKETS

A. Types: Provide brackets and equip with left or right flanges as shown on approved shop drawings to accommodate shelving layout indicated on Drawings.

B. Material:

1. Powder Paint Coated Steel: 12 gauge steel sheet complying with ASTM A1008 phosphate primed and finished with electrostatically applied plastic powder resin paint. Finish and color to match shelves.

C. Size: As required to accommodate shelf depth.

D. Provide brackets with clamp assemblies designed to rigidly attach brackets to uprights.

1. Type: Split unit with profile to match tubular slot extension of upright. Provide with 3/8 inch diameter bolt and nut for attachment.

2. Material: Electro-zinc-plated steel in accordance with ASTM B633 and chromate dipped.

2.7 ACCESSORIES

A. Fasteners: Provide fasteners as required for secure, rigid installation to meet specified performance requirements. Type, size, and spacing shall be as recommended by manufacturer and indicated on approved shop drawings. Minimum fasteners shall be:

1. Wood Studs and Blocking: 1/4 inch diameter lag screws, 2-1/2 inches long.
2. Metal Studs, Concrete Unit Masonry, and Hollow Tile: 1/4 inch diameter toggle bolts.
3. Masonry and Concrete Walls: Expansion shields with 1/4 inch diameter lag screws, 2-1/2 inches long.

B. End Panels: Provide full height, solid metal end panels for ends of storage units.

1. Width: Match shelf depth

2. Material:

a. Powder Paint Coated Steel: 16 gauge steel sheet complying with ASTM A1008 phosphate primed and finished with electrostatically applied plastic powder resin paint. Finish and color to match shelves.

3. Mounting: Provide L-shaped edge strip to fit under shelf and attach to shelf bracket. End panels to be bolted to edge strips.

C. Base Closures: Provide metal closure pieces to install at bottom of shelving units and form solid flush base.

1. Size: Height to match foot bracket. Width to match shelf width.

2. Material:

a. Powder Paint Coated Steel: 16 gauge steel sheet complying with ASTM A1008 phosphate primed and finished with electrostatically applied plastic powder resin paint. Finish and color to match shelves.

3. Mounting: Provide flanges for closure pieces to wrap around shelf and screw attach to foot bracket.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate requirements for stud spacing, blocking, and auxiliary structural supports to ensure adequate means for installation of shelving system.

B. Coordinate shelving system layout with columns, wall-mounted pipes and conduit, and other wall protrusions. Provide cut-outs in shelving such that components fit tight around protruding elements. Field verify required dimensions.

C. Coordinate installation of shelving system with application of floor, wall, and ceiling finishes. To the extent possible, install shelving components after finishes have been applied.

3.2 INSPECTION

A. Before Installation:

1. Inspect substrates to receive shelving and verify surfaces are smooth, plumb, and suitable for anchoring uprights.
2. Inspect storage system components for damage. Do not install bent, dented, scratched, or otherwise damaged items.
3. Verify all required components are available

3.3 INSTALLATION

A. Install shelving system in accordance with approved shop drawings and manufacturer's installation instructions.

B. Layout storage system with temporary markings to indicate upright locations.

C. Wall-Mounted Uprights: Accurately space uprights and install plumb with fasteners of type, size, and spacing recommended by manufacturer for type of substrate.

D. Brackets: Insert shelf brackets in uprights and secure with clamp assemblies. Ensure brackets are accurately aligned so installed shelves will be level.

E. Shelves: Position shelves on brackets, align mounting holes, and anchor with fasteners of type, size, and spacing recommended by manufacturer.

F. Accessories: Install accessories in locations indicated on approved shop drawings. Install components rigidly, secure, plumb, and level with fasteners of type, size, and spacing recommended by manufacturer.

3.4 ADJUSTING AND CLEANING

A. Remove and replace damaged components.

B. Touch-up minor scratches on painted components with manufacturer provided paint matching original finish.

3.5 CLEANING

A. Thoroughly clean and polish storage system components.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.6 PROTECTION

A. Protect installed storage system components from subsequent construction activities

END OF SECTION 10 5613

SECTION 11 6100 - LABORATORY FUME HOODS

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 the following:

1. Bench-top laboratory fume hoods.
2. Fume hood base cabinets with countertops.
3. Laboratory sinks and cup sinks in fume hoods.
4. Water, laboratory gas, and electrical service fittings in fume hoods.
5. Piping and wiring within fume hoods for service fittings, light fixtures, blower switches, and other electrical devices.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring fume hoods.
2. Division 22, 23 and 26 Sections for connecting service utilities to fume hoods. Piping and wiring within fume hoods are specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.

B. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20% of the average face velocity at any designated measuring point as defined in this section.

C. Average illumination of work area: Minimum 80 footcandles. Work area shall be defined as the area inside the superstructure from side-to-side, from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches.

D. Fume hood shall be designed to minimize static pressure loss, with adequate slot area and bell shaped exhaust collar configuration. Maximum average static pressure loss readings, taken three diameters above the hood outlet from four points 90 degrees apart, shall not exceed the following maximums with sash in full open position:

Face Velocity	Measured S.P.L. (W.G.)
60 .P.M.	.15 inches
100 F.P.M.	.30 inches

E. Fume hood shall maintain essentially constant exhaust volume at any sash position for safety. Maximum variation in exhaust CFM and static pressure as a result of sash adjustment shall not exceed 5% for any sash position at the specified exhaust volume.

F. Fume hoods shall be available in standard and custom widths (as indicated on the schedule) with a useable interior depth of 24 inches.

G. Noise Criteria: Test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Reading shall be taken 3' in front of an open sash, 5' off the floor at 100 fpm face velocity.

H. Interior and exterior materials of construction and finishes shall meet the usage and specification requirements.

1.4 POLYRESIN LINER SURFACE FINISH PERFORMANCE REQUIREMENTS

A. Test procedure:

1. Test No. 1 – Spills and Splashes:

   a. Suspend in a vertical plane: a 42" (horizontal) by 12" (vertical) panel divided into 3/4" wide vertical columns, each column numbered 1 through 49.
   b. Apply five drops of each reagent listed with an eyedropper.
   c. Apply liquid reagents at top of panel and allow to flow down full panel height. (CAUTION! Flush away any reagent drops.)

2. Test No. 2 – Fumes and Gases:

   a. Divide 24" x 12" panel into 2" squares, each square numbered 1 through 49.
   b. Place 25 milliliters of reagent into 100 milliliter beakers and position panel over beaker tops in the proper sequence. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.

3. After 24 hours remove panel, flush with water, clean with naphtha and detergent, rinse, wipe dry and evaluate.

B. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

1. No Effect: Any detectable change in surface material.
2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.

C. Test Results:

	REAGENT LIST Concentrations by Weight	**Test No.1 Rating Spills**	**Test No. 2 Fumes**
1.	Sodium Hydroxide Flake	---	No Effect
2.	Sodium Hydroxide, 40%	Excellent	No Effect
3.	Sodium Hydroxide, 20%	Excellent	No Effect
4.	Sodium Hydroxide, 10%	Excellent	No Effect
5.	Ammonium Hydroxide, 28%	No Effect	No Effect
6.	Eldorado—Plus (Solution)	No Effect	No Effect
7.	Chloroform	Excellent	No Effect
8.	LpH SE (Solution)	No Effect	No Effect
9.	Trichloroethylene	Excellent	No Effect
10.	Monochlorobenzene	Excellent	No Effect
11.	Tincture of Iodine	Excellent	Excellent
12.	Methyl Alcohol	No Effect	No Effect

13.	Ethyl Alcohol	No Effect	No Effect
14.	Butyl Alcohol	No Effect	No Effect
15.	Phenol, 85%	Excellent	No Effect
16.	Cresol	Excellent	No Effect
17.	Sodium Sulfide, Saturated	Good	No Effect
18.	Furfural	Fair	No Effect
19.	Dioxane	No Effect	No Effect
20.	Zinc Chloride, Saturated	No Effect	No Effect
21.	Benzene	Excellent	No Effect
22.	Toluene	Excellent	No Effect
23.	Xylene	Excellent	No Effect
24.	Gasoline	Excellent	No Effect
25.	Naphthalene	Excellent	No Effect
26.	Methyl Ethyl Ketone	Excellent	No Effect
27.	Acetone	Excellent	No Effect
28.	Ethyl Acetate	Excellent	No Effect
29.	Amyl Acetate	Excellent	No Effect
30.	Ethyl Ether	Excellent	No Effect
31.	Silver Nitrate, 10%	Good	No Effect
32.	Di Methyl Formamide	No Effect	Excellent
33.	Formaldehyde, 37%	No Effect	No Effect
34.	Formic Acid, 88%	No Effect	No Effect
35.	Acetic Acid, Glacial	No Effect	No Effect
36.	Dichloro Acetic Acid, 93%	Excellent	Excellent
37.	Chromic Acid, Saturated	Good	No Effect
38.	Phosphoric Acid, 85%	No Effect	No Effect
39.	Sulfuric Acid, 33%	No Effect	No Effect
40.	Sulfuric Acid, 77%	Excellent	No Effect
41.	Sulfuric Acid, 93%	Good	No Effect
42.	Hydrogen Peroxide, 30%	No Effect	No Effect
43.	Acid Dichromate	Excellent	No Effect
44.	Nitric Acid, 20%	Excellent	No Effect
45.	Nitric Acid, 30%	Excellent	No Effect
46.	40 & 47 Equal Parts	Excellent	Good
47.	Nitric Acid, 70%	Excellent	Good
48.	Hydrochloric Acid, 37%	No Effect	Excellent
49.	Hydrofluoric Acid, 48%	No Effect	Failure

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For laboratory fume hoods. Include plans, elevations, sections, details, and attachments to other work.

1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.
2. Indicate locations and types of service fittings together with associated service supply connection required.
3. Indicate duct connections, electrical connections, and locations of access panels.
4. Include roughing-in information for mechanical, plumbing, and electrical connections.

C. Samples for Verification: For factory-applied finishes interior lining and countertop material, in manufacturer's standard sizes.

D. Product Test Reports: Based on evaluation of comprehensive tests according to SEFA 1.2, "Laboratory Fume Hoods--Recommended Practices" and ANSI/ASHRAE 110-2016 performed by manufacturer and witnessed by a qualified independent testing agency, for fume hoods.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain laboratory fume hoods through one source from a single manufacturer.

1. Obtain through same source and from same manufacturer as laboratory casework specified in Division 12 Section "Wood Laboratory Casework."

B. Product Designations: Drawings indicate sizes, types, and configurations of fume hoods by referencing designated manufacturer's catalog numbers. Other manufacturers' hoods of similar sizes, types, and configurations, and complying with the Specifications may be considered. Refer to Division 01 Section "Product Requirements."

C. Product Standard: Comply with the following:
1. SEFA 1-2020, "Fume Hoods - Recommended Practices."
2. SEFA 2-2020, "Installation - Recommended Practices."
3. ANSI/ASHRAE 110-2016: Laboratory Fume Hoods Performance Testing

D. Safety Glass: Products complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.9 COORDINATION

A. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.

1.10 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

B. Warranty: Provide manufacturer's one-year warranty against defects in materials and workmanship. Subject to provisions of the warranty, manufacturer agrees to repair or replace non-conforming products or its parts for the warranty period following substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: **Supreme Air Venturi** fume hood as manufactured by **Kewaunee Scientific Corporation**, 2700 West Front Street, Statesville, North Carolina.

B. Available Manufacturers: Subject to compliance with requirements, other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Jamestown Metal Products, Inc.
2. Mott Manufacturing Ltd.
3. Hamilton Scientific

2.2 FUME HOOD DESCRIPTIONS

A. SUPREME AIR VENTURI FUME HOODS

1. Fume Hood (**H1**)

   a. Model: Model: V15 – ADA Bench Fume Hood with vertical rising sash.
   b. Sizes: 24” depth x 72” width.

2. Fume Hood (**H2**)

   a. Model: V05 – General Purpose Bench Fume Hood with vertical rising sash.
   b. Sizes: 24” depth x 72” width

3. Fume Hood (**H3**)

   a. Model: H-Series non-standard Custom – ADA Bench Fume Hood with vertical rising sash.
   b. Sizes: 24” depth x 70” width. (Custom width)
   c. Pass through sash opening

4. Fume Hood (**H4**)

   a. Model: V05 – General Purpose Bench Fume Hood with vertical rising sash.
   b. Sizes: 24” depth x72” width.

5. Fume Hood (**H5**)

   a. Model: V05 – General Purpose Bench Fume Hood with vertical rising sash.
   b. Sizes: 24” depth x72” width.

6. Fume Hood (**H6**)

   a. Model: V15 – ADA Bench Fume Hood with vertical rising sash.
   b. Sizes: 24” depth x 72” width.

B. CONTAINMENT

1. Hoods shall be tested in strict compliance with the ANSI/ASHRAE 110-2016 standards for Laboratory Fume Hoods Performance Testing.

2. As Manufactured (AM) Rating: Hoods shall achieve a rating of 4.0 AM 0.05 (0.05 PPM at a 4 L per minute release rate) or better when factory tested following the ANSI/ASHRAE 110-2016 standards in the following conditions:
    a. With the vertical sash fully open (28 inches min.) and a face velocity of 60 FPM or less.
    b. With the vertical sash open to standard operating height (18 inches min.) and a face velocity of 100 FPM or less.
3. As Installed (AI) Rating: Once installed, hoods shall achieve a rating of 4.0 AI 0.1 (0.1 PPM at a 4 L per minute release rate) or better when field tested following the ANSI/ASHRAE 110-2016 standards in the following conditions:
    a. With the vertical sash fully open (28 inches min.) and a face velocity of 60 FPM or less.
    b. With the vertical sash open to standard operating height (18 inches min.) and a face velocity of 100 FPM or less.

C. SUPREME AIR VENTURI FUME HOOD MATERIALS

1. Steel: High quality, cold-rolled mild steel, meeting requirements of ASTM A1008; gauges U.S. Standard and galvanized.
2. Stainless steel: Type 304; gauges U.S. Standard.
3. Ceiling closure panels: Minimum 18 gauge; finish to match hood exterior.
4. Downdraft bypass: Low resistant type, 18 gauge steel chamber, directional louvers—not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a down flow direction. Chamber shall protect user from expelled particulate in the event of an adverse internal reaction.
5. Safety glass: 7/32" thick laminated safety glass or 3/8" thick laminated safety glass viewing panel.
6. Sash chain: ANSI #35 steel, single strand. Average tensile strength of 2,400 pounds; maximum working load of 480 pounds.
7. Type S Spec Grade GFCI recpetacles.
8. Air Alert Alarm.
9. Sash guides: Extruded PVC.
10. Pulley assembly for sash chain: Finish bored steel drive sprockets and keyed drive, 1/2” diameter front connector shaft. Rear idler sprockets; double sealed ball bearings, lubricated. All sprockets steel with zinc dichromate finish.
11. Sash pull: Corrosion resistant steel with chemical resistant powder coating. Maximum 1.5" thick.
12. Gaskets: White 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood.
13. Fastenings:

    a. Exterior structural members’ attachments: Sheet metal screws, zinc plated.
    b. Interior fastening devices concealed. Exposed screws not acceptable. (Screw head “caps” not acceptable.)
    c. Exterior side access panel member fastening devices to be exposed corrosion resistant, non-metallic material, creating a positive mechanical latch. Latch must be flush type. Exposed screws or Velcro fasteners—not acceptable.

14. Instruction plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information covering recommended locations for apparatus, accessories, baffle settings and use of sash.
15. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4-7/8" thick.

    a. Wall consists of a sheet steel outer shell with urethane powder finish and a corrosion resistant inner liner. This wall houses and conceals steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Panels must be attached to a full frame construction, minimum 14-gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracket from hood interior.

    b. Access to fixture valves concealed in wall provided by exterior removable access panels, gasket access panels on the inside liner walls, or through removable front posts.

16. Exhaust outlet: Rectangular with ends radiused, shaped and flanged, 18-gauge steel finished with urethane powder coating.

17. Access opening perimeter: Airfoil or streamlined shape with all right angle corners radiused or angled. Bottom horizontal foil shall provide nominal one-inch bypass when sash is in the closed position. Bottom foil shall be removable without use of special tools. Bottom foil shall provide access area sufficient in size to pass thru hospital grade electrical plugs. Bottom foil: Steel with urethane powder coating to increase acid and abrasion resistance. Airfoil and sill to be low profile design. A secondary containment trough shall be located in front of the work surface and extend below the airfoil sill.
18. Fume hood sash: (Vertical) Full view type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections. Sash to have a 35-inch sight line and a 28" vertical access height. Bottom sash rail: 2" maximum, 18-gauge steel with powder coating finish. Provide integral formed, flush pull the full width of bottom rail. Full width extruded dual durometer bottom bumper and airflow control strip. Set safety glass into rails in deep form, extruded poly-vinyl chloride glazing channels available on constant volume and restricted bypass hoods.
19. Fume hood sash: (Combination) Vertical and horizontal sash access with a 35" high sight line. Sash shall be top hung on nylon tired stainless steel ball bearing wheels. Sash frame on bottom and sides must be no more than 1.5" thick and radiused to minimize turbulence. Area above the 28" vertical sash opening shall be glazed with a minimum of 3/8" thick laminated safety glass. All glass to have polished exposed edge treatment. Horizontal panels provided with finger pulls. Combination sash is available on restricted bypass hoods only.
20. Counter balance system: Single weight, sprocket and chain, counter balance system which prevents sash tilting and permits ease of operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full 18" height of operating sash opening. Life cycle test sash and weight. Provide independent test data. (See 2.02 F, G and H for material descriptions.) Open and close sash against rubber bumper stops.
21. Airfoil: The airfoil will be low profile, relatively flush to the work surface with ample room for hospital grade electrical cords to fit beneath the airfoil. This sill to be used on both sash types. Sill to be ergonomically radiused on front edge. Sill must pivot forward to provide cord and trough access. Airfoil sills that are not low profile are not acceptable.
22. Fume hood liner: Polyresin (product number denoted by the suffix "P"): Reinforced polyester panel; smooth finish and white color in final appearance. Flexural strength: 14,000 psi. Flame spread: 17 or less per U.L. 723 and ASTM E84-80. Baffle must be same material as liner. Metallic baffles, brackets or supports on hood interior—not acceptable. Liner and baffle material *must* meet 1.03 performance test. Independent test validation is mandatory.
23. Baffles: Baffles providing controlled air vectors into and through the fume hood must be fabricated of the same material as the liner. Provide minimal exhaust slots full height on vertical sides of the baffle. High performance two piece baffle will be used. Baffle shall incorporate exhaust slots located to purge the upper and lower area of the hood. Baffle to be non-adjustable. Baffles with manual or automatic adjustment are not acceptable. All baffles, supports, and brackets to be non-metallic.
24. Auto-Sash: Sash shall be designed to promote usage as an upper body and face shield. Face velocities and volumes shall be based on an 18" operating opening. Sash shall have the capability to be raised to full 28" vertical opening for loading or unloading of large apparatus. A lock-open shall be provided. The Auto-sash return shall provide an automatic gravity operated sash return that lowers the sash to 18" from the full-open setup position. When the sash is raised to the full open position, a sash lock holds the sash open for setup purposes. By pressing the electric sash stop release button, the sash automatically closes to the 18" operating height. Auto-sash function shall be life cycle tested and not incorporate the need for motor drives. Submit third party validation of life cycle tests.
25. Service fixtures and fittings [specified option]: Color-coded hose nozzle outlets and valves mounted inside the fume hood and controlled from the exterior with color-coded index handles.

    a. Valves (except as otherwise indicated, and subject to Architect's approval): Needlepoint with self-centering cone tip and seat of hardened stainless steel. Tip and seat shall be replaceable.
    b. Provide piping for all service fixtures from valve to outlet: Galvanized iron or copper for water, air and vacuum; black iron for gas services.
    c. Fixtures exposed to hood interior: Brass with chemically resistant color-coded powder coating.
    d. Remote control handles: Four-arm handle with nylon color-coded index buttons.

        1) Provide lever handles on ADA fume hoods.

    e. Services: As shown or specified.

26. Service fixtures and fittings:

    a. Service treatment: Fittings are to be coated with a chemically resistant polyester powder lacquer electrostatic ally applied and backed on for a uniform finish.
    b. Handle and outlet nozzle will be color coded to the media. Outlet nozzles shall be made of the same high-quality brass as the valve bodies. Other materials may be in contact with media where appropriate.
    c. Provide piping for all service fixtures from valve to outlet: Galvanized iron or copper for water, air and vacuum; black iron for gas services.
    d. Fixtures exposed to fume hood interior shall have a chemical resistant finish.
    e. Fixtures are to be provided with easy to mount attachment device for secure mounting in deck or wall mounted applications. System to be installed with simple hand tools.
    f. Where required for ADA compliance, and subject to Architect approval, provide rod control ball valves with lever handles.
    g. Fittings are to be constructed to operate with the following *maximum working pressure* without leak or failure.
        - Water Fittings: 145 PSI
        - Non-Burning Gas: 145 PSI
        - Burning Gases: 100 PSI
        - Special Water Fittings: 145 PSI
        - Oxygen Fittings: 145 PSI

    h. All outlets shall have detachable, serrated nozzles.

27. Hood light fixture: UL listed LED light fixture. Provide safety glass panel cemented and sealed to the hood roof.

    a. Interior of fixture: White, high reflecting plastic enamel.
    b. Size of fixture: Largest possible up to 48" for hoods with superstructures up to seven feet. Provide two 36" fixtures for hoods with eight-foot superstructures.
    c. Include lamps with fixtures. Hoods without lamps are not acceptable.
    d. Illumination: Per performance values, Part 1 of this Section.
    e. Access to light thru lintel panel—no tools required.

28. Electrical services: Three wire grounding type receptacles rated at 120 V.A.C. at 20 amperes. Provide 250 V.A.C. receptacles where specified. Flush plates: Black acid resistant thermoplastic.
29. Work surfaces: 1-1/4" thick surface, dished a nominal 3/8" to contain spills.
30. Paper Screen: Consists of cold rolled expanded metal and applied with Electro statically applied finish to prevent corrosion. The expanded metals are 18 gauge with spacing not to exceed 1-1/4".
31. Safety Monitor/Alarm System: Where shown or specified, provide Safety Monitor/Alarm System, which monitors face velocity and provides audible and visual alarm if face velocity drops below safe levels. As the internal fume hood pressure changes while the sash is closed and opened, the flow passing over the thermistor is calibrated to a face velocity, which is displayed on the monitor front.

    a. Safety monitor: UL listed, tamper proof, with all alarm circuits, electric components, external tubing, and manifolds furnished complete and factory installed.
    b. Perform final calibration in the field once the hood is stationed and the hood exhausts and room supply systems are balanced.
    c. Airflow sensor: Thermally compensated glass-beaded thermistor, factory connected to a sidewall port on the interior of the fume hood.
    d. Alarm Signal: Audible and visual signal.

        1) Silence pushbutton, which disables the audible alarm, shall be accessible on the front of the safety monitor.
        2) Provide alternate mode in which audible alarm is silenced indefinitely but visual alarm remains activated until the alarm condition is corrected.
        3) When alarm conditions are corrected and face velocity and volume return to specified levels, the Safety Monitor will automatically reset and begin routine monitoring.

e. Provide test circuit to verify proper Safety Monitor operation.

32. Bypass shall be sufficient in size to allow 25% flow with sash closed. Bypass must be achieved through low resistance opening at top of front lintel panel. Bypass shall be designed to provide a smooth down flow effect.
33. Width: As shown on drawings.
34. Metal finish:

a. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pre-treat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.
b. Application: Electro statically apply urethane powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thickness:

1) Exterior and interior exposed surfaces: 1.5 mil average and 1.2 mil min.

2) Backs of cabinets and other surfaces not exposed to view: 1.2 mil average. Liquid, dipped, solvent based finishes are not and will not be acceptable.

35. Cabinet Surface Finish Tests: All casework construction and performance characteristics shall be in full compliance with SEFA 8 standards. At the owner's request, independent, third party performance testing must be submitted validating compliance and adheres to the finish specifications.

a. **Chemical Spot Test**

Purpose of Test
The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.
Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

Test Procedure
Obtain one sample panel measuring 14" x 24" (355.6mm x 609.6mm). The received sample to be tested for chemical resistance as described herein. Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48 hours at 73+ 3F (23(+ 2(C))and 50+ 5% relative humidity. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods:

Method A—Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a one-ounce (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B—Test volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down. For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naphtha, and rinse with deionized water. Dry with a towel and evaluate after 24 hours at 73±3°F (23°±2°C) and 50±5% relative humidity using the following rating system:

Level 0 — No detectable change.
Level 1 — Slight change in color or gloss.
Level 2 — Slight surface etching or severe staining.
Level 3 — Pitting, cratering, swelling, or erosion of coating, as well as obvious and significant deterioration.

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	A
2.	Acetate, Ethyl	A

3.	Acetic Acid, 98%	B
4.	Acetone	A
5.	Acid Dichromate, 5%	B
6.	Alcohol, Butyl	A
7.	Alcohol, Ethyl	A
8.	Alcohol, Methyl	A
9.	Ammonium Hydroxide, 28%	B
10.	Benzene	A
11.	Carbon Tetrachloride	A
12.	Chloroform	A
13.	Chromic Acid, 60%	B
14.	Cresol	A
15.	Dichlor Acetic Acid	A
16.	Dimethylformanide	A
17.	Dioxane	A
18.	Ethyl Ether	A
19.	Formaldehyde, 37%	A
20.	Formic Acid, 90%	B
21.	Furfural	A
22.	Gasoline	A
23.	Hydrochloric Acid, 37%	B
24.	Hydrochloric Acid, 48%	B
25.	Hydrogen Peroxide, 3%	B
26.	Iodine, Tincture of	B
27.	Methyl Ethyl Ketone	A
28.	Methylene Chloride	A
29.	Mono Chlorobenzene	A
30.	Naphthalene	A
31.	Nitric Acid, 20%	B
32.	Nitric Acid, 30%	B
33.	Nitric Acid, 70%	B
34.	Phenol, 90%	A
35.	Phosphoric Acid, 85%	B
36.	Silver Nitrate, Saturated	B
37.	Sodium Hydroxide, 10%	B
38.	Sodium Hydroxide, 20%	B
39.	Sodium Hydroxide, 40%	B
40.	Sodium Hydroxide, Flake	B
41.	Sodium Hydroxide, Saturated	B
42.	Sulfuric Acid, 33%	B
43.	Sulfuric Acid, 77%	B
44.	Sulfuric Acid, 96%	B
45.	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	B
46.	Toluene	A
47.	Trichloroethylene	A
48.	Xylene	A
49.	Zinc Chloride, Saturated	B

Acceptance Level

Results will vary from manufacturer to manufacturer. Laboratory grade finishes should result in no more than four Level 3 conditions. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

b. **Hot Water Test**

Purpose of Test

The purpose of this test is to ensure the coating is resistant to hot water.

Test Procedure
Hot water, 190°F to 205°F (88°C to 96°C), shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.44cc) per minute on the surface, which shall be set at an angle of 45-degrees, for a period of five minutes.

Acceptance Level
After cooling and wiping dry, the finish shall show no visible effect from the hot water.

c. **Impact Test**

Purpose of Test
The purpose of this test is to evaluate the ductility of the coating.

Test Procedure
A one-pound ball approximately 2" (50.8mm) in diameter shall be dropped form a distance of 12" (304.8mm) onto a flat horizontal surface, coated to manufacturer's standard manufacturing method.

Acceptance Level
There shall be no visible evidence to the naked eye of cracks or checks in the finish due to impact.

d. **Paint Adhesion on Steel Test**

Purpose of Test
The paint adhesion test is used to determine the bond of the coating to steel. This does not apply to non-steel products.
Test Procedure
This test is based on ASTM D2197-86 "Standard Method of Test for Adhesion of Organic Coating". Two sets of eleven parallel lines 1/16" (1.587mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush for one minute. Examine under 100 footcandles of illumination.

Acceptance Level
Ninety or more of the squares shall show finish intact.

e. **Paint Hardness on Steel Test**

Purpose of Test
The paint hardness test is used to determine the resistance of the coatings to scratches.

Test Procedure
Pencils, regardless of their brand, are valued in this way: 8-H is the hardest, and next 11 order of diminishing hardness are 7-H, 6-H, 5-H, 4-H, 3-H, 2-H, H, F, HB, B (soft), 2-B, 3-B, 4-B, 5-B (which are softest).
The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel-like manner until one is found that will cut or scratch the film. The pencil used before that one, that is the hardest pencil that will not rupture the film, is then used to express or designate the hardness.

Acceptance Level
The paint shall have a hardness of 4-H minimum.

D. RESTRICTED BYPASS FUME HOODS

1. Bypass shall be sufficient in size to allow 25% flow with sash closed. Bypass must be achieved through grill or louver on face of front lintel panel.
2. Sash: Standard vertical-rising.
3. Width: As shown on drawings.

E. BYPASS TYPE FUME HOODS

1. Constant volume type with built-in automatic compensating bypass to maintain constant exhaust volume regardless of sash position.
2. Bypass: Positive in action and controlled by the sash operation.
3. Low impedance, directionally louvered panel provided in the lintel bypass area and one inch bypass provided immediately above the work surface and directly below the bottom horizontal sash rail. Designs which require all bypass to enter hood over front solid panel—not acceptable.
4. As sash is lowered, bypass design shall limit the increase in face velocity to maximum of four times the average face velocity with the sash full open.
5. Width: As shown on drawings.

F. METAL FINISH

1. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pretreat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.
2. Application: Electrostatically apply urethane powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade furniture quality finish of the following thicknesses:

    a. Exterior and interior surfaces exposed to view: 1.5 mil average and 1.2 mil minimum.
    b. Backs of cabinets and other surfaces not exposed to view: 1.0 mil average.

2.3 ACCESSORIES

A. Fume Hood Cup Sinks

1. Polyolefin oval, shallow cupsink with elbow.
2. Furnish and install cup sink(s) per drawings.
3. Coordinate required cutout size in fume hood epoxy resin work surfaces. Cup sink location as shown on drawings.

B. Face Velocity Labels

1. Furnish and install one set per fume hood.

C. Static Pressure Gauge

1. Model 54L31300.
2. Furnish and install one gauge per fume hood.

D. Fume Hood Base Cabinets

1. Model numbers as shown on drawings.
2. Furnish and install two filler end panels, per fume hood, except four for ADA fume hoods.
3. For each base cabinet for acid storage, furnish and install polyethylene vent pipe.
4. For each base cabinet for flammable storage, furnish and install polyolefin vent pipe.
5. For each acid or flammable storage base cabinet, furnish and install polyolefin shelf protector tray, 2” lip.

E. Fume Hood Panels

1. Fume Hood Panels: Two side enclosure panels, one front ceiling and sash enclosure panel, one lower back enclosure panel, one left ceiling enclosure panels, one right ceiling enclosure panel, and one upper back ceiling enclosure panel. Match sizes to fume hoods.

F. Ceiling Enclosure Panels:

1. Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to above the ceiling system. Fasteners to be concealed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation:

1. Install fume hoods and equipment in accordance with manufacturer's instructions.
2. Install equipment plumb, square, and straight with no distortion and securely anchored as required.
3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.

B. Accessory Installation: Install accessories and fittings in accordance with manufacturer's recommendations.

C. Fasten together assemblies to comply with Performance Requirements specified above.

D. Comply with requirements in Divisions 22 and 26 for installing water and laboratory gas service fittings and electrical devices.
1. Install fittings according to approved Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink- and work top-mounted fittings in sealant recommended by manufacturer of sink or work top material. Securely anchor fittings to fume hoods unless otherwise indicated.

E. Field Joints: Reinforce and weld in manner equivalent to shop welds and joints.

F. Wall Joints:
1. Joints between equipment and walls up to 3/8 inch wide:
   a. Fill with backing rod or tape and silicone sealant.
   b. Comply with requirements of Section 079213 "Elastomeric Joint Sealants."
   c. Apply sealant in one continuous pass, compressing surface slightly concave and forcing contact with both sides of joint.
2. Joints between equipment and walls greater than 3/8 inch wide:
   a. Seal with stainless-steel closure or filler strip.
   b. Fit tightly and fasten securely with concealed clips.

G. Site Tolerances: Install wall-to-wall countertops with a maximum 1/4-inch gap.

3.2 FIELD QUALITY CONTROL TESTING OF FUME HOODS

A. Field testing requirements:

1. Field test installed fume hoods to verify compliance with performance requirements:
   a. Test each hood per ANSI/ASHRAE 110-2016 standards Velocity and Smoke Visualization tests.
   b. Testing shall be performed in the field for each hood. Successfully passing the containment performance testing will be achieved with a control level for five-minute average tests at each location that meet or exceed the As Installed (AI) Containment requirements listed above with the fume hood product requirements.

2. Adjust fume hoods, hood exhaust fans, and buildings HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.
   a. After making corrections, re-test fume hoods that failed to perform as specified.

3. Use only qualified personnel to perform tests in field to verify proper operation of the fume hoods before they are put in use.
    a. Field test shall be performed by a qualified independent third-party contractor, not the fume hood manufacturer or a representative or affiliate of the manufacturer.
    b. Perform tests after installation is complete, the building ventilation system has been balanced, all connections have been made, and written verification has been submitted that the above conditions have been met.
    c. Verify that the building make-up air system is in operation, the doors and windows are in normal operating position, and that all other hoods and exhaust devices are operating at designed conditions.
    d. Correct any unsafe conditions disclosed by these tests before request of test procedures.

3.3 ADJUSTING

A. Repair or replace defective work as directed by Architect upon completion of installation.

B. Adjust sash, fixtures, accessories and other moving or operating parts to function smoothly.

3.4 CLEANING

A. Clean equipment, touch up as required.

3.5 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of equipment to other construction activity.

B. To prevent hoods from damage by work of other trades, advise contractor of necessary precautions.

3.6 DEMOSTRATION AND TRAINING

A. Start-up Demonstration and Instruction of Client Agency Personnel: Comply with requirements of General Conditions, Division 01 General Requirements, and Commissioning.

B. Upon completion of the installation of fume hoods, Contractor and Manufacturer shall conduct a training seminar for the Client Agency's users at the job site, discussing proper operation of the fume hood, fume hood features, and best use practices.

C. Demonstrate equipment functions and field certification process. Supply instructional materials.

D. Training session shall be at least 30 minutes in length, not including a question-and-answer session. Training session to be scheduled within 30 days of completion of the installation.

END OF SECTION 11 6100

SECTION 12 3553.19 - WOOD LABORATORY CASEWORK

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. Wood laboratory casework.
2. Auxiliary cabinets.
3. Mobile Cabinet.
4. Utility-space framing at backs of base cabinets.
5. Filler and closure panels.
6. Laboratory casework system that includes support and utility-space framing, filler and closure panels, and undercabinet lighting.
7. Laboratory countertops.
8. Shelves.
9. Laboratory sinks.
10. Laboratory accessories.
11. Full height storage shelving.
12. Fittings.
13. Tables.
14. Gas Cylinder Wall Bracket.

B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring laboratory casework.
2. Section 11 6100 "Laboratory Fume Hoods" for fume hoods, including base cabinets and countertops under fume hoods.

1.3 DEFINITIONS

A. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets, including those installed directly against walls or other cabinets, are defined as "exposed."
2. Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets are defined as "concealed."

B. Semiexposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cases 78 inches or more above floor and bottoms of cabinets more than 24 inches but less than 48 inches above floor are defined as semiexposed.

C. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

D. Hardwood Plywood: A panel product composed of layers, or plies, of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive and faced both front and back with hardwood veneers.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site with Owner and Architect.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review and discuss the installation of laboratory casework that is required to be coordinated with the installation of finishes, hoods, power, water, and laboratory gas services, drains, and other affected Work.
   3. Review and discuss the sequence of work required to construct complete working assemblies.
   4. Inspect and discuss the condition of substrate and other preparatory work performed by all trades.

B. Keying Conference: Conduct conference at Project site with Owner. Incorporate keying conference decisions into final keying requirements.

1.5 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.

B. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.

C. Coordinate installation of laboratory casework with installation of mechanical, electrical and plumbing fittings.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For laboratory casework. Include plans, elevations, sections, and attachment details.

   1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required of installation.
   2. Indicate types and sizes of casework.
   3. Indicate manufacturer’s catalog numbers for casework.
   4. Indicate locations of hardware and keying of locks.
   5. Indicate locations and types of service fittings.
   6. Show fabrication details, including types and locations of hardware.
   7. Include details of utility spaces showing supports for conduits and piping.
   8. Include details of support framing system.
   9. Include details of exposed conduits, if required, for service fittings.
   10. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
   11. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents and Owner.

D. Number Plate Schedule: Include schematic numbered diagram, and index each number plate to unique designations that are coordinated with the Construction Documents and Owner.

E. Samples for Verification: Unless otherwise directed, approved full-size Samples may become part of the completed Work, if in an undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations. If acceptable full-size Samples at Project site are not incorporated into the Work, retain and remove them when directed by Architect.

1. One full-size, finished base cabinet complete with hardware, doors, and drawers.
2. One full-size, finished wall cabinet complete with hardware, doors, and adjustable shelves.
3. One full-size, finished tall cabinet complete with hardware, doors, and adjustable shelves.
4. 6-inch-square Samples for each type of countertop material.
5. One of each service fitting specified, complete with accessories and specified finish.
6. One of each type of sink and accessory item specified.
7. One of each type of hardware item specified.
8. Full-Size Samples: Maintain at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise indicated, approved sample units may become part of the completed Work if in undisturbed condition at time of Substantial Completion. Notify Architect of their locations.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Test Reports for Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard and system structural performance specified in "Performance Requirements" Article.

C. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each type and color of wood laboratory casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8 W.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where laboratory casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.12 WARRANTY

A. Furnish a written warranty that Work performed under this Section shall remain free from defects as to materials and workmanship for a period of two (2) year from date of acceptance. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner. Defects include, but are not limited to:

1. Ruptured, cracked, or stained coating.
2. Discoloration or lack of finish integrity.
3. Cracking or peeling of finish.
4. De-lamination of components or edge banding.
5. Slippage, shift, or failure of attachment to wall, floor, or ceiling.
6. Weld or structural failure (visible weld marks).
7. Warping or unloaded deflection of components.
8. Failure of hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Kewaunee Scientific Corporation; Laboratory Products Group** or comparable product by one of the following:

1. Mott Manufacturing Ltd.
2. Diversified Woodcrafts, Inc.
3. Hamilton Scientific

B. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.

1. Obtain countertops, sinks, and accessories from casework manufacturer.

C. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes and similar door and drawer configurations and complying with Specifications may be considered.

2.2 PERFORMANCE REQUIREMENTS

A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Support Framing System: 600 lb/ft.
2. Suspended Base Cabinets (Internal Load): 160 lb/ft.

3. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft.
4. Wall Cabinets (Upper Cabinets): 160 lb/ft.
5. Shelves: 40 lb/sq. ft.

2.3 CASEWORK, GENERAL

A. Casework Product Standard: Comply with SEFA 8 W, "Laboratory Grade Wood Casework."

B. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.

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.

D. Low-Emitting Materials: Fabricate casework, including countertops, with adhesives and composite wood products containing no urea formaldehyde.

2.4 WOOD CASEWORK

A. Design: Flush overlay; eased edge.

1. Provide 1/16-inch reveals between doors and drawers that are adjacent.

B. Wood Species: **White maple.**

C. Cut: Plain sliced/sawn (flat cut).

D. Matching:

1. Provide veneers for each cabinet from a single flitch, book and running matched.

a. Provide continuous matching of adjacent drawer fronts within each cabinet.

E. Grain Direction:

1. Vertical on both doors and drawer fronts, with continuous vertical matching.
2. Vertical on end panels.
3. Vertical on knee-space panels.
4. Horizontal on aprons and table frames.

F. Exposed Materials:

1. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
2. Plywood: Hardwood plywood, either veneer core or particleboard core, made without urea formaldehyde with face veneer of species indicated. Grade A exposed faces, at least 1/50 inch thick, and Grade J crossbands. Provide backs of same species as faces.
3. Solid Wood: Clear hardwood lumber of species indicated.

G. Semiexposed Materials:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of same species as exposed solid wood.

2. Plywood: Hardwood plywood of same species as exposed plywood. Grade B faces and Grade J crossbands. Provide backs of same species as faces.
3. Provide solid wood or hardwood plywood for semiexposed surfaces unless otherwise indicated.

H. Concealed Materials:

1. Solid Wood: Any species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood. Provide backs of same species as faces.
3. Hardboard.

2.5 WOOD CABINET MATERIALS

A. General:

1. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated and made without urea formaldehyde.

C. Hardboard: ANSI A135.4, Class 1 Tempered.

D. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch-thick, solid wood of same species as face veneer.

1. Select wood edgebanding for grain and color compatible with face veneers.
2. Colors: As selected by Architect from manufacturer's full range.

2.6 COUNTERTOP, SHELF AND SINK MATERIALS

A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide **Kemresin**, or comparable product by one of the following:

a. Durcon, Inc.
b. Greenstone, by Durcon, Inc.
c. Hamilton Scientific.
d. Kewanee

2. Physical Properties:

a. Flexural Strength: Not less than 10,000 psi.
b. Modulus of Elasticity: Not less than 2,000,000 psi.
c. Hardness (Rockwell M): Not less than 100.
d. Water Absorption (24 Hours): Not more than 0.02 percent.
e. Heat Distortion Point: Not less than 260 deg F.

3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

4. Color: Basis-of-Design: **Kemresin: Slate.**

5. Product Designations: Drawings indicate size and locations of laboratory epoxy sinks by referencing numbers. Other manufacturer's epoxy sinks of similar sizes complying with specifications may be considered.

2.7 FABRICATION

A. Construction: Provide wood-faced laboratory casework complying with SEFA 8 W and of the following minimum construction:

1. Bottoms of Base Cabinets and Tall Cabinets: 3/4-inch-thick, veneer-core hardwood plywood.
2. Tops and Bottoms of Wall Cabinets and Tops of Tall Cabinets: 1-inch-thick, veneer-core hardwood plywood.
3. Ends of Cabinets: 3/4-inch-thick, hardwood plywood.
4. Shelves: 1-inch-thick, veneer-core hardwood plywood.
5. Base Cabinet Top Frames: 3/4-by-2-inch solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
6. Base Cabinet Stretchers: 3/4-by-4-1/2-inch panel product strips or solid-wood boards at front and back of cabinet, glued and pinned or screwed.
7. Base Cabinet Subtops: 3/4-inch-thick panel product glued and pinned or screwed.
8. Exposed Backs of Cabinets: 3/4-inch-thick, hardwood plywood.
9. Unexposed Backs of Cabinets: 1/4-inch-thick, hardwood plywood dadoed into sides, bottoms, and tops, unless otherwise indicated.
10. Drawer Fronts: 3/4-inch-thick, hardwood plywood or solid hardwood.
11. Drawer Sides and Backs: 1/2-inch-thick, solid hardwood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
12. Drawer Bottoms: 1/4-inch-thick, veneer-core hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch-thick material for drawers more than 24 inches wide.
13. Doors 48 Inches High or Less: 3/4 inch thick, solid-hardwood stiles and rails, and hardwood face veneers and crossbands.
14. Doors More Than 48 Inches High: 1-1/8 inches thick, with plywood cores and hardwood face veneers and crossbands.

B. Removable Backs: Provide backs that can be removed from within cabinets at utility spaces.

C. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.

1. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed.
2. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
3. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.

2.8 MOBILE CABINET

A. Mobile Demo Bench: Multi-purpose workstation serving both lecture and laboratory function, easily movable and reconfigurable to adapt to changing classroom requirements.

1. Worksurface shall be 1" Kemresin resin and supported by heavy gauge steel tubing support structure, securely welded and bolted for stability, and able to support 1200 lbs. The table shall include a 3/4" thick white maple veneer core plywood modesty panel below the worksurface, finished to match other casework on the project. All steel components shall be protected with a chemical resistant, VOC free, powder coat finish. Interior of cabinet to have shroud for receptacle.

    a. The table shall rest on: four (4) removable heavy-duty locking casters capable of supporting 1200 lb dynamic load. Casters shall be interchangeable with a floor glide assembly.

b. Grommet Basis-of-Design Product: Mockett XG3 – 3" FlipTop Grommet Set with Cap and Liner. Color to match worksurface.

c. GFCI Duplex receptacle with two high power USB ports: USB-A and USB-C.
   1) 15A, 125V, 25 watts
   2) Comply with requirements in Section 262726 "Wiring Devices"
   3) CSA certified, UL Listed

2.9 AUXILIARY CABINETS

A. Acid Storage Fume Hood Cabinet: Acid Storage fume hood cabinets shall utilize the same materials and construction features as other base cabinets. In addition, they shall have a one piece liner insert made of linear low density polyethylene. The liner insert shall form a one-inch high pan at the bottom to retain spillage. The door shall be lined with a polyethylene sheet. Each cabinet shall be vented with a 1-1/2" vent pipe. It shall provide a positive airflow directly into the fume hood exhaust system.

B. Solvent Storage Cabinet:
   1. Solvent storage cabinets shall be specifically designed for storage of flammable and combustible liquids. Construction shall be based upon th3 requirements listed by UFC, OSHA, and NFPA No. 30-2008.
   2. Fabricate bottom, top, sides, and doors of 18 gauge steel using double-panel construction with a 1 1/2-inch air space between panels. Joints shall be welded or screwed to provide a rigid enclosure.
   3. Provide fully insulated doors with full-length stainless steel piano hinges. Equip right hand door with a three-point latching device that automatically engages when the doors close. Equip left hand door with full-height astragal. Doors shall be self-closing and synchronized so that both doors will aways fully close. Equip each door with a fusible-link hold-open feature that will ensure the doors close should the temperature outside the cabinet exceed 165 degrees F.
      a. 24-inch-long units shall have only one door, self-closing, and equipped with a three-point latching system and hold-open feature.
   4. Provide a 2-inch-deep liquid-tight pan that covers the entire bottom of the cabinet to contain liquid leaks and spills.
   5. Provide full-depth adjustable shelves. Shelves shall allow air circulation within the cabinet.
   6. Provide two diametrically opposed vents with spark screens in the back of the cabinet as well as a grounding screw.
   7. Interior finish to match exterior.
   8. Mark cabinet with conspicuous label: FLAMMABLE – KEEP FIRE AWAY.
   9. Refer to Drawings for face dimensions.

2.10 WOOD FINISH

A. Preparation: Sand lumber and plywood before assembling. Sand edges of doors, drawer fronts, and molded shapes with profile-edge sander. Sand after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.

B. Staining: Remove fibers and dust and apply stain to exposed and semiexposed surfaces as necessary to match approved Samples. Apply stain in a manner that produces a consistent appearance. Apply wash-coat sealer before applying stain to closed-grain wood species.

   1. Stain Color: Basis of Design: **202 Seaside Maple**

C. Chemical-Resistant Finish: Apply laboratory casework manufacturer's standard two-coat, chemical-resistant, transparent finish. Sand and wipe clean between coats. Topcoat(s) may be omitted on concealed surfaces.

   1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8 W. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.

2.11 HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges:

1. Hinges shall be the (5) knuckle, satin finish stainless steel, institutional, offset type for all swinging doors. Hinges shall be 2-3/4" long, and secured to cabinet and doors with flathead screws, so applied to withstand a weight load of 150lbs. minimum.

C. Hinged Door and Drawer Pulls: **Kewaunee Stainless Steel Wire – Pull 4**, back-mounted pulls. Provide two pulls for drawers more than 24 inches wide.

1. Design: Wire Pull
2. Overall Size: As selected from manufacturer's full range.

D. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.

1. Provide Grade 1; for drawers not more than 6 inches high and 24 inches wide.
2. Provide Grade 1HD-100; for drawers more than 6 inches high or 24 inches wide.
3. Standard Duty (Grade 1): Full-extension type, with polymer rollers.
4. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Full-extension, ball-bearing type.

E. Drawer Slides: Hardwood runners under centers of drawers with polymer guides fastened to backs of drawers.

F. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches, attached with screws or rivets. Provide where indicated on drawings.

G. Locks:

1. PinTumbler

a. Locks when shown or called for shall be a 5-pin tumbler with heavy duty interchangeable cylinder. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers. Locks shall have capacity for 1000 primary key changes, and the capacity to Masterkeyed, Grand-masterkeyed, Sub-Masterkeyed, and Mason Keyed.

2. Padlock Hasps

a. Padlock Hasps where indicated on drawings shall be chrome plated padlock hasp mounts, and is interchangeable with tumbler locks. Include stainless steel wear plate that protects drawer heads and door wear and denting by the Padlock. Padlocks to be provided by Owner. Basis of Design is Kewaunee designation L being added to the cabinet number.

H. Adjustable Shelf Supports: Powder-coated steel shelf rests complying with BHMA A156.9.

I. Adjustable Wall Shelf Supports: Surface-type steel standards and steel shelf brackets, with epoxy powder-coated finish, complying with BHMA A156.9.

J. Number Plates: Zinc plated, pre-printed, installed in field: Confirm number layout with Architect in shop drawing legend. Provide where indicated on drawings.

K. Countertop Support Brackets: Epoxy powder coated, 11 gauge steel with integral cleat mount opening and wire management opening; Hafele Work Surface Brackets, sizes as required; provide where indicated on drawings.

L. Base Molding: Base molding per Section 09 6513 Resilient Base and Accessories.

2.12 COUNTERTOPS, SHELVES AND SINKS

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch, with continuous drip groove on underside 1/2 inch from edge.

1. Outside Corners: Round all outside corners 1/2 inch radius; radius not shown on drawings.

B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.
2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches less than sink depth. Provide in same material as strainer.

C. Epoxy Countertops, Tabletop, and Sinks: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.
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. Basis of Design: Kemresin
    b. American Epoxy Scientific LLC.
    c. Durcon; a Wilsonart Company.
    d. Or equal, subject to Architect approval
2. Physical Properties:
    a. Flexural Strength: Not less than 10,000 psi.
    b. Modulus of Elasticity: Not less than 2,000,000 psi.
    c. Hardness (Rockwell M): Not less than 100.
    d. Water Absorption (24 Hours): Not more than 0.02 percent.
    e. Heat Distortion Point: Not less than 260 deg F.
3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
    a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
    b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
4. Color: To match countertop.
5. Countertop and Tabletop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.

    a. Countertop Configuration: Flat, 1 inch thick, with beveled edge and corners, and with drip groove and integral coved backsplash.

6. Sink Fabrication: Molded in one piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.

    a. Provide with polypropylene strainers and tailpieces.
    b. Provide sinks for drop-in installation with 1/4-inch-thick lip around perimeter of sink and proper support from below.
    c. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.

2.13 LABORATORY ACCESSORIES

A. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop unless otherwise indicated. Provide stainless steel round earthquake lips at all shelves on all sides.

B. Pegboards: Epoxy, glassware drying rack pegboards with removable polypropylene pegs and epoxy drip troughs with drain outlet and tubing to the sink.

1. Size: Pegs to be varied lengths of 3", 4", and 5" long. (As indicated on drawings)

C. Gas Cylinder Wall Brackets: Basis-of-Design Product: **Uline Model No. H-10676**.

1. Polyester straps with steel buckles to hold tank in place.
2. Cushioned bumper guards for scratchless grip.

2.14 FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis of Deign: WaterSaver Faucet Co.
2. Broen A/S
3. Kewaunee

B. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures – Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

1. Provide units that comply with "Vandal-Resistant Faucets and Fixtures" recommendations in SEFA 7.

C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.

1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.

D. Finish: Acid- and solvent-resistant powder coating complying with requirements in SEFA 7 for corrosion-resistant finishes.

1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard white.

E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig.

1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
3. Self-Closing Valves: Provide self-closing valves where indicated.

F. Faucet Mounted Eyewash: At faucet locations indicated on the drawings, provide faucet mounted eyewash.

1. Basis of Design: WaterSaver, EW201 EyeSafe-X, Faucet Mounted Eyewash with Faucet Control Valve.

G. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig, with serrated outlets.

H. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf to operate. Provide units designed for working pressure up to 75 psig, with serrated outlets.

1. Where ball valves are indicated for fuel-gas use, provide locking safety handles that must be pushed in or pulled up before being turned on unless otherwise indicated.

I. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig, with serrated outlets.

J. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.

1. Provide units designed for working pressure up to 125 psig.

K. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L".

L. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.

M. Handles: Provide three- or four-arm, forged-brass or three- or four-wing, powder –coated metal handles for valves unless otherwise indicated.

1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
3. Provide heat-resistant plastic handles for steam valves.
4. Provide knurled, molded plastic handles for needle valves.

N. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

2.15 ELECTRICAL SERVICE FITTINGS

A. Service Fittings, General: Provide units complete with metal housings, receptacles, terminals, switches, pilot lights, device plates, accessories, and gaskets required for mounting on laboratory casework.

B. Electrical Wiring Devices: Comply with requirements in Section 262726 "Wiring Devices" for receptacles, switches, pilot lights, cover plates, and accessories.

C. Receptacles: Comply with NEMA WD1, NEMA WD6, and UL 498. Duplex type, Configuration 5 20R.

1. Receptacle Grade: General grade unless otherwise indicated.
2. Color of Receptacles: White unless otherwise indicated or required by NFPA 70.
3. GFCI Receptacles: Straight blade, feed-through or non-feed-through type. Comply with UL 943, Class A, General grade, and include indicator light that is lighted when device is tripped.

D. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.

E. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Architect from manufacturer's full range.

F. Cover Plates: Provide white cover plates with formed, beveled edges.

G. Cover Plate Identification: Use 1/4-inch-high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.

1. Provide at the following locations and where indicated on drawings:

a. Receptacles other than standard 125-V duplex, grounding type.
b. Switches and thermal-overload switches.
c. Pilot lights when located remotely from associated equipment or switch, where function is not obvious.

d. Receptacles, switches, and other locations indicated.

2. Provide the following information:

a. Voltage and phase for receptacles other than standard 125-V duplex, grounding type.
b. Indicate equipment being controlled by switches and thermal-overload switches.
c. Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
d. Number of breaker in panelboard that controls the device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of laboratory casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prior to beginning installation of casework, check and verify that no irregularities exist that would affect quality of execution of work specified.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.
1. Before installation, condition wood countertops to average prevailing humidity conditions in installation areas for not less than 72 hours.

C. Coordinate the work of the Section with the schedule and other requirements of other work being prepared in the area at the same time both with regard to mechanical and electrical connections to and in the fume hoods and the general construction work.

3.3 INSTALLATION OF CABINETS

A. Comply with installation requirements in SEFA 2. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than two fasteners per side.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16 inches o.c.

E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

F. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.4 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

1. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

C. Fastening:

1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide required holes and cutouts for service fittings.

E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

G. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.5 INSTALLATION OF SINKS

A. Comply with installation requirements in SEFA 2.

B. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not shop prepared. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

C. Drop-in Installation of Epoxy Cup Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

3.6 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories according to Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions.

B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.7 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.

B. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.8 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
   1. Comply with manufacturer cleaning instructions.
   2. Do not use materials and methods that may damage finish and surrounding construction.
   3. Clean countertops on exposed and semiexposed surfaces.
   4. Touch up shop-applied wood finishes to restore damaged or soiled areas.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

C. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

END OF SECTION 12 3553.19

SECTION 22 0500 - GENERAL PROVISIONS AND COMMON WORK RESULTS FOR PLUMBING

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 the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Access Panels.
9. Plumbing demolition.
10. Cleaning up/removal of debris.
11. Equipment installation requirements common to equipment sections.
12. Operating and maintenance data and owner instruction.
13. Traps.
14. Flashing.
15. Painting and finishing.
16. Concrete bases.
17. Supports and anchorages.
18. Materials prohibited.
19. Certification.
20. Guarantee of Work.
21. Final plumbing connections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

H. The term "as indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

I. It is the intention of these Contract Documents to call for finished work, tested and ready for operation.

1. The word "PROVIDE" shall mean "furnish and install, complete and ready for use" all items noted on the drawings and/or indicated in the Specifications.
2. The word "FURNISH" shall mean "supply and deliver to the job site" all items noted on the drawings and/or indicated in the Specifications. The items will be installed by the Owner or another contractor.
3. The word "INSTALL" shall mean "install complete and ready for use" all items furnished by the Owner or another contractor which are noted on the drawings and/or indicated in the Specifications to be installed by the Plumbing Contractor.
4. The word "RELOCATE" shall mean "move from the existing location to the new location installed complete and ready for use" all items noted on the drawings and/or indicated in the Specifications.

J. References made to Plumbing Contractor throughout Division 22 is intended to refer to the contractor or subcontractor who will furnish and install Plumbing materials and equipment.

1.4 QUALIFICATIONS FOR BIDDERS

A. The Plumbing Contractor shall be experienced in work similar to that indicated for this Project and shall have a record of successful in-service performance.

B. Upon request, the Plumbing Contractor shall provide a listing of similar jobs with references.

C. Before submitting bid, the Plumbing Contractor shall visit the site and examine existing conditions on which his work is in any way dependent. The Plumbing Contractor shall immediately report to the Architect any condition which might prevent him from installing his equipment in the manner intended.

1.5 BID SUBMISSION REQUIREMENTS

A. The Plumbing Contractor shall submit his bid, including the Base Bid and all Alternate Bids, in accordance with the General Provisions of the Contract, including General, Supplementary and Special Conditions.

B. Only one manufacturer shall be listed for each equipment item.

1.6 LAWS, CODES, AND REGULATIONS

A. All work shall be installed in accordance with accepted trade standards or practices. Accepted trade standards or practices shall be documented and shall be based on sound engineering design principles. Accepted trade standards or practices must include a statement indicating that the specific application in question is included within its scope. Accepted trade standards and practices must be documented through an engineering society or trade organization.

B. Failure to follow laws, codes, public regulations and accepted trade standards or practices will result in rejection of the work. All rejected work shall be removed and replaced at no additional cost to the Owner.

C. Nothing contained in these Specifications or shown on the Drawings shall be construed to be in conflict with state or local codes, ordinances or regulations governing the installation of the work specified herein. Should any change in the Drawings and/or Specifications be required in order to conform to the applicable codes, ordinances, regulations or laws, the Plumbing Contractor shall notify the engineer immediately upon discovery of the violation.

D. Products furnished for this project shall be "LEAD FREE" as required by Federal legislation passed on January 4, 2011. This entails the wetted surfaces of plumbing fixtures, equipment, valves, etc. described in each section to have a weighted-average lead content of no more than 0.25% when used in applications intended to convey or dispense water for human consumption through drinking or cooking.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable Building Codes.

1. Commonwealth of Pennsylvania, Department of Labor and Industry.

a. Fire and Panic Regulations.
b. Regulations Governing Boilers and Unfired Pressure Vessels.

B. Fire Protection: Conform to NFPA 13.

C. Plumbing: Conform to the 2015 International Plumbing Code.

D. Energy conservation shall be provided for plumbing systems as described in the Pennsylvania Building Energy Conservation Act 222.

1.8 PERMITS, FEES, AND NOTICES

A. The Plumbing Contractor shall give all requisite notices, obtain and pay all deposits and fees necessary for the installation, tests connections to the utility company service lines, street openings, repairs and inspection of all work provided under this Specification. These tests shall be conducted in the presence of the Architect.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed in each section form a part of that Section to the extent referenced.

B. The publication date is the publication in effect as of the bid date, except when a specific publication date is specified.

C. Obtain copies of referenced standards direct from publication source when needed for proper performance of work, or when required for submittal by Contract Documents.

1.10 SCOPE OF WORK

A. The work to be performed consists of the satisfactory completion of all Plumbing work, as indicated in the Contract Documents.

B. The work to be performed under these specifications shall include providing all labor, materials and equipment necessary to furnish and install, complete, properly and fully, all Plumbing Work as shown on drawings, herein specified and/or necessary thereto, whether or not specified herein in detail, and/or reasonably implied, and leaving the same in satisfactory operating condition. It is the intent of these specifications that a complete and operating system shall be installed and this Contractor shall carefully examine the site, plans, and specifications, and shall include all items necessary to accomplish this purpose.

1.11 SCHEDULING OF WORK

A. This project consists of renovation work. Due to the size, scope and time required to complete this work, it may be necessary to perform the work in phases in order to allow the owner to continue with their business operations with a minimum amount of disruption.

B. The Contractor shall thoroughly review the plumbing drawings, along with the architectural drawings, for the phasing sequence and shall incorporate into his bid the impact the phasing sequence and the construction schedule has on the Plumbing work in this project.

C. Initially, upon award of all construction contracts, work shall begin on new construction. Early in this portion of the work, and so as to avoid or minimize disruption to the owner.

1.12 DESCRIPTION OF SYSTEMS

A. Without intending to limit or restrict the volume of work required by this Specification and the applicable drawings, the work generally consists of:

1. Complete Plumbing systems including sanitary, waste, vent, hot water, cold water and lab piping, specialties and equipment.
2. Installation of new electric steam boiler, pumps, piping and piping specialties.
3. Extension of existing plumbing system with new fixtures, piping, specialties and equipment.
4. Thermal insulation of equipment and piping.
5. Concrete pads for all floor mounted equipment.
6. Cleaning of all equipment, piping, and fixtures.
7. Painting of equipment, piping, supports and hangers.
8. Testing, balancing and adjusting.
9. Cutting and patching for new work in the existing building.
10. Demolition work as required.
11. Vibration isolation equipment.
12. Structural and Mechanical Engineering services for the design and support of all piping systems for pipe sizes 6" and larger.
13. Operating and maintenance instructions and manuals.
14. Demonstration of successful system operation.

1.13 EQUIPMENT FURNISHED UNDER OTHER CONTRACTS

A. Unless otherwise specified or shown on the drawings, this Contractor shall make final plumbing connections to all equipment furnished under General and Electrical Contracts. For HVAC equipment, this Contractor shall provide a capped water outlet within two (2) feet of the HVAC equipment, and the HVAC Contractor shall make and be responsible for the final connections. For HVAC gas fired equipment, this Contractor shall make the final gas connections to the equipment.

B. Unless otherwise specified or shown on drawings, the equipment furnished under the concurrent contracts will be furnished with their operating controls. This Contractor shall provide valves on water and gas, and unless otherwise shown or specified traps on waste outlets, and shall furnish all labor and materials required to connect the equipment and make it operative. Unless otherwise shown or specified valves on lines to equipment shall be ball valves.

C. Equipment furnished under other contracts will be set in place by the Contractor for that equipment. Controlling devices for this equipment will be furnished with the equipment, but were supplied detached, they shall be installed into the plumbing work piping assemblies by the Plumbing Contractor.

D. This Contractor shall refer to the shop drawings of equipment furnished under other contracts to obtain the locations of connections and arrangements of piping assemblies to which he is required to connect. All the required pipe, fittings, adapters, couplings and other accessories required to make the equipment operative shall be provided by this Contractor.

E. Products furnished to the site and paid for by the Owner.

1.14 SPACE PRIORITY

A. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems.
2. Vent piping systems.
3. Ceiling recessed lighting fixtures.
4. Concealed air terminal units, fans.
5. Air duct systems.
6. Sprinkler systems piping.
7. Forced flow piping systems.
8. Electrical conduit, wiring, control wiring.

B. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.

C. Change in order of priority is permissible by mutual agreement of all affected trades.

D. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.

E. The work of a particular trade shall not obstruct access for installation, operation and maintenance of the Work, materials and equipment of another trade.

F. This Contractor shall verify roughing-in dimensions for all fixtures and equipment prior to his roughing-in for such fixtures and equipment.

1.15 DEMOLITION WORK

A. The Plumbing Contractor shall demolish all work as outlined on the drawings.

B. The Owner shall decide the disposition of all salvaged materials. The Plumbing Contractor shall deliver to the Owner all materials identified to be salvaged.

C. When demolishing existing equipment, the Plumbing Contractor shall remove all existing piping, supports, hangers, hanger rods, anchor bolts, structural steel, and concrete pads related to the work being removed.

D. Where demolition of work results in unsightly openings in occupied spaces or jeopardizes the integrity of a fire or smoke barrier, the opening shall be patched in accordance with the paragraph in this section entitled "Cutting Patching, and Finishing".

E. Where demolition requires the removal of a concrete equipment pad, remove the pad, cut all anchor bolts, dowel pins, and steel bases off flush with the floor so as to eliminate any tripping hazard. Fill any openings, voids, or holes with a fine cement grout or another appropriate floor patching material. Provide surface finish to match adjacent flooring material.

1.16 CUTTING AND PATCHING

A. Cutting and patching shall be in accordance with Division 1 Section “Execution”.

B. The Plumbing Contractor shall seal all openings he has utilized in fire-rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire-rating equal to or greater than the rating of the floor, ceiling or partition material.

C. The Plumbing Contractor shall be responsible for providing all cutting, patching, and finishing of existing construction which is not specifically shown on the Architectural Drawings and which is required for the proper installation of his equipment and materials which are to be installed in the existing portion of this project. This work shall also be provided when removing existing equipment and materials. All cutting shall be kept to an absolute minimum consistent with the requirements of the project.

D. Cutting, patching and finishing shall be performed by workmen skilled in this type of work. All patching shall be done utilizing materials of the same quality and texture as the adjacent undisturbed areas. All finishing shall match the undisturbed adjacent areas. Painting of the final finished areas, where general construction work occurs, will be the responsibility of the General Contractor. Painting of the final finished areas, where no general construction work occurs, shall be the responsibility of the Plumbing Contractor. The Plumbing Contractor shall paint entire plane in which damage occurs whether the surface is a wall or a ceiling.

E. No cutting shall be done which may affect the building structurally or architecturally without first consulting with the General Contractor and then securing the approval of the Architect. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons or other construction. Where such unsightly conditions are caused, the Plumbing Contractor shall be required, at his own expense, to repair the damaged areas. Note all holes or openings in existing concrete or masonry shall be drilled, core bored or saw cut.

F. Where present equipment or material is removed and unused openings remain in walls, floors, partitions, etc., the Plumbing Contractor shall properly patch all such openings.

1.17 RECORD DRAWINGS

A. Provide in accordance with Division 01 Section PROJECT RECORD DOCUMENTS and as stated below.

B. The Plumbing Contractor shall:

1. During the construction period, maintain in good order a complete set of blue line plumbing contract drawings. Record the actual Plumbing installation as the work progresses. Include all changes to the contract and to equipment sizes and types. Keep these drawings available at the site at all times for inspection.
2. Take proper caution against the use of superseded drawings. Check all such copies and mark "void". Where drawings have been corrected by memorandum, assume the responsibility for marking all drawings so affected with the changes; such marked drawings shall remain in use until revised drawings are issued.

3. At the conclusion of the work, this contractor shall furnish to the Architect a CD-Rom containing all of the Plumbing Drawings. The Drawings shall be in AutoCAD format and shall show all "as-built" conditions. The Drawings shall indicate all changes made during construction, including tagging and room names. The CD-Rom shall accompany the submission of the red-lined Drawings required in Division 01.
4. Red-line a clean set of Specifications to include approved substitutions, change orders, actual equipment and materials used and installed.

1.18 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable plumbing systems complete in every respect.

B. Any apparatus, appliance, material or work not shown as standard industry practice on drawings, but mentioned in the specifications, or vice versa, shall be provided by the Plumbing Contractor without additional expense to the Owner.

C. The drawings are diagrammatic, intending to show general arrangement and location of system components, and are not intended to be rigid in detail.

D. Due to the small scale of the drawings, all required offsets and fittings may not be shown but shall be provided at no change in Contract price.

E. As many of the small lines required for the complete installation are shown on the drawings as is practicable, but some may have been omitted. The Contractor shall do all such piping that may be required or directed to effect proper connections to all apparatus, equipment, and fixtures in accordance with the manufacturer's detailed drawings and instructions.

F. The equipment schedules shown on the drawings list the manufacturer used as the basis of design in the preparation of the Bid Drawings. The equipment specifications list that manufacturer as well as other manufacturers the Engineer, Architect and/or Owner find acceptable from a performance and product quality standpoint. Listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether they have a positive or negative monetary impact on the design shown on the Bid Drawings. In addition, listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether the dimensions of these products will have a negative impact on the space allotted for this equipment. If the Contractor or his Subcontractors decide to use a product or manufacturer that is listed as acceptable in the specifications but is different from the product or manufacturer scheduled on the drawings, it will be the responsibility of the Contractor or his Subcontractors to fully explore the product to ensure that it can be installed in the space allotted and shall pay any and all costs (including additional professional design fees) associated with the use of these products or manufacturers that impact the structure, the electrical system(s), the HVAC system(s) and/or the Plumbing system(s) due to an increase in weight, electrical load, drain and vent requirements, connection sizes, etc., between the scheduled item and the equipment item used.

1. Use of a product or manufacturer not scheduled on the Bid Drawings constitutes a representation that:

    a. The Plumbing Trade has investigated the proposed product and determined that the product can be installed within the space allotted.
    b. The Plumbing Trade will coordinate the installation of product used into the work
    c. The Plumbing Trade will be responsible for making all changes as may be required to make the work complete in all respects; waives all claims for additional costs under his responsibility, which may subsequently become apparent.

1.19 SUBMITTALS

A. Provide in accordance with Division 01 Section SUBMITTAL PROCEDURES and as stated below.

B. Submit plans to the Pennsylvania Department of Labor and Industry (L&I) Boiler Division. Install water heaters, fired and unfired pressure vessels in conformance with approved drawings providing all required valves, platforms, ladders, exits and clearances. Submit approved L&I drawings to Architect before construction.

C. Submit Product Data, shop drawings, and samples in accordance with the General Conditions and Supplementary Conditions, within 60 days of award of contract for every item of material, etc. used.

D. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed shop drawings, product data and samples will be needed.

E. Shop Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Contract Drawings.

F. All drawings prepared by the Plumbing Contractor, for the Plumbing Contractor's use, shall be submitted for approval. Such drawings include, but are not limited to, pipe fabrication and layout drawings, Plumbing piping and layout drawings, equipment layout drawings, coordination drawings, and drawings of miscellaneous details.

G. Office samples shall be of sufficient size and quantity to clearly illustrate functional characteristics of the product, with integrally related parts and attachment devices, and full range of color, texture and pattern.

H. The Plumbing Contractor shall be responsible for reviewing shop drawings, product data and samples prior to submission. The Plumbing Contractor shall clearly mark or highlight the submittal to indicate all pertinent information such as model number, dimensions, capacities, clearances, performance characteristics, etc., and shall delete any data which is not relevant to the work. The Plumbing Contractor shall also determine and verify field measurements, field construction criteria, catalog numbers and similar data, and conformance with specifications.

I. The Plumbing Contractor shall coordinate each submittal with requirements of the work and of the Contract Documents.

J. The Plumbing Contractor shall notify the Architect in writing, at time of submission, of any deviations in the submittals from requirements of the Contract Documents.

K. The Plumbing Contractor shall begin no fabrication or work which requires submittals until return of submittals with Architect approval.

L. The Plumbing Contractor shall make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other Contractor.

M. Unless required otherwise by the General Conditions or the Supplementary Conditions, the number of submittals required shall be as follows:

1. Shop Drawings: Submit the number of opaque reproductions which the Plumbing Contractor requires, plus three copies, one will be retained by the Architect, one copy will be retained by the Engineer, and one copy will be retained by the Owner.
2. Product Data: Submit the number of copies which the Plumbing Contractor requires, plus three copies; one copy will be retained by the Architect, one copy will be retained by the Engineer, and one copy will be retained by the Owner.
3. Samples: Submit the number stated in each specification section.

N. The Plumbing Contractor shall also include in each submittal the date of submission and the dates of any previous submissions; the project title and number; the names of the Plumbing Contractor, the supplier, and the manufacturer; identification of the product, with the specification section number; identification of revisions on resubmittals; and the Plumbing Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field

measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

O. For resubmission requirements, the Plumbing Contractor shall make any corrections or changes in the submittals (i.e., shop drawings, samples or product data) required by the Architect and resubmit until approved.

P. The Architect will review submittals with reasonable promptness and in accordance with schedule, affix stamp and initials or signature, and indicate requirements for resubmittal, or approval of submittal, and return submittals to Plumbing Contractor for distribution, or for resubmission.

Q. Equipment and piping shop drawings shall be produced and submitted in accordance with the paragraph in this section entitled "Cooperation and Coordination with Other Trades".

R. Submittals for equipment and pumps shall include manufacturer's published performance curves showing flow rate, pressure drop, efficiency, horsepower, NPSH required (for pumps), and operating points.

S. As soon as practicable, and within 30 days after the date of award of contract, and prior to installation of any equipment or material a completed schedule of equipment and material proposed for installation shall be submitted to the A/E for approval.

T. All material submitted for approval, excepting special equipment and special adaptation of regular equipment as hereinafter specified and as specifically shown on the drawings, shall be standard printed matter made available by the manufacturer to the public and in effect at the time of opening of bids and shall indicate that the material or equipment is regularly produced and recommended for the service required. In the event any items of material or equipment contained in the schedule fail to comply with the specification requirements, such items may be rejected.

U. In the event that the contractor fails to submit the required schedule of materials and equipment within the allowed time, the A/E will select a complete line of materials, fixtures, and equipment. The selection made shall be final and binding, and the items shall be furnished and installed by the contractor without any change in contract price or time of completion.

V. Product Data - for the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

W. Welding certificates.

1.20 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Provide in accordance with Division 01 Section SUBSTITUTION PROCEDURES and as stated below.

B. It will be the responsibility of this contractor to pay any and all costs associated with any approved substitutions which impact the structure, the electrical system(s), the plumbing system(s) and/or the Plumbing system(s) due to an increase in weight, electrical load, drain requirements, connection sizes, etc., between the approved substitution item and the equipment item scheduled and/or indicated as the basis of design.

C. For products specified only by reference standard, select any product meeting that standard. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the drawings and specifications. For products specified by naming one or more products or manufacturers and "or equal", Plumbing Contractor must submit a request as for substitutions for any product or manufacturer not specifically named.

D. The Architect will consider written requests from the Plumbing Contractor for substitution of products by manufacturers not listed in the Specification for a period up to 10 days prior to the Bid. Within this period, submit a separate request for each product, supported with complete data, with drawings and samples as appropriate and as required under the "submittals" paragraph in this section to include: Comparison of the qualities of the proposed substitution with that specified; changes required in other elements of the work because of the substitution; effect on the construction schedule; cost data comparing the proposed substitution with the product specified; availability of maintenance service, and source of replacement materials.

E. A request for a substitution constitutes a representation that the Plumbing Contractor has investigated the proposed product and determined that it is equal to or superior in all respects to that specified; can be installed within the space allotted; will provide the same warranties or bonds for the substitution as for the product specified; will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects; waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

F. The Plumbing Contractor will compensate the Architect and Engineer on a time and material basis for their costs involved in reviewing a substitution.

1.21 OPERATING AND MAINTENANCE DATA AND OWNER INSTRUCTION

A. Provide in accordance with Division 01 Section OPERATION AND MAINTENANCE DATA and as stated below.

B. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under this Contract in a neatly bound and tabulated format. The manual shall be bound in a standard 1 inch three-ring binder.

C. The manual shall contain as a minimum: models and serial numbers for the equipment; description of the equipment/system and its components; recommended routine, preventative and emergency maintenance; start-up, operating and safety instructions; recommended frequency of inspection; oil type; belt tension adjustment; performance curves, engineering data, and tests; "trouble-shooting guide"; a spare parts list; and names, addresses and telephone numbers for the equipment installer, the maintenance contractor, and the local spare parts source.

D. Provide complete operating and maintenance information for products specified in:

1. Section 22 0519: Meters and Gauges for Plumbing Piping.
2. Section 22 0523: General Duty Valves for Plumbing Piping.
3. Section 22 0700: Plumbing Insulation.
4. Section 22 1119: Domestic Water Piping Specialties.
5. Section 22 1319: Sanitary Waste Piping Specialties.
6. Section 22 3300: Electric Steam Boiler.
7. Section 22 4500: Emergency Plumbing Fixtures.

E. Submit one copy of completed operating and maintenance manual in pre-final form 30 days prior to final inspection or acceptance for approval. The copy will be returned before final inspection or acceptance, with comments.

F. Submit three (3) copies of revised operating and maintenance manual in final 10 days after return of the pre-final operating and maintenance manual.

G. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in order, adjustment and maintenance of products, equipment and systems. The instruction shall consist of a minimum of one 8-hour session on site. The session shall include a review of the contents of manual with personnel in full detail to explain all aspects of operations and maintenance. Instruction shall be arranged at the Owner's convenience.

1.22 QUALITY ASSURANCE

A. Provide in accordance with Division 01 Section QUALITY REQUIREMENTS.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.23 DELIVERY, STORAGE, HANDLING, AND PROTECTION

A. Provide in accordance with Division 01 Section PRODUCT REQUIREMENTS and as stated below.

B. Arrange deliveries of products in accordance with construction schedules. Coordinate to avoid conflict with work and conditions at the site. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

C. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

D. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

E. 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.

F. Store new products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store new products or items being re-used in a manner to prevent damage due to the elements, prevent damage due to construction operations at the site, and allow for ease of inspection.

G. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

H. The Plumbing Contractor, at his own expense, shall make good to the Architect and the Owner's satisfaction any damage to his work incurred by the action of the elements or any other cause due to the neglect on the part of the Plumbing Contractor or his representatives.

I. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.24 PROTECTION OF SERVICES AND EQUIPMENT

A. Repair, replace and maintain in service any utilities, facilities or services (underground, aboveground, interior and/or exterior) which are damaged, broken, or otherwise rendered inoperative during the course of construction. The method used in repairing, replacing or maintaining the services shall be approved by the Architect and/or Engineer.

B. The Plumbing Contractor shall protect all work, materials and equipment during the construction period. All openings must be securely covered, or otherwise protected, in order to prevent injury due to dropped tools, materials or dirt.

1.25 SPECIAL CONDITIONS RELATED TO PLUMBING WORK

A. During the course of construction, cap or otherwise seal off, in an approved manner, those portions of the piping system in which work is not being performed, in order to prevent the entry of dirt or dust.

B. The Plumbing Contractor shall coordinate all utility shut-downs with the Owner.

C. Install equipment along with control devices and all replaceable fittings with sufficient clearance for operation and maintenance functions.

D. Do not install piping in transformer vaults or electrical equipment rooms. In accordance with the National Electric Code Article 110-34f, do not install piping adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.

E. Exposed piping shall be run so as to allow maximum headroom consistent with proper pitch. Piping shall not interfere with any light, opening, door, window or equipment. Headroom in front of openings, doors and windows shall not be less than the top of the opening. Minimum clearance of 1 inch shall be maintained around all piping, valves and fittings.

F. Outside, underground piping shall have a minimum of 36 inches of earth cover, except provide greater coverage to equal locally recorded frost penetrations.

G. Lay out the work and establish all heights and grades required for installation.

H. All material and equipment to be furnished under this contract shall be new and shall conform to the grade, quality and standards specified herein. Items of equipment shall be the latest standard product as advertised in printed catalogues by reputable manufacturers for the purpose intended and shall have replacement parts available. All materials and equipment shall be American made.

I. Equipment shall be installed in strict accordance with the manufacturer's instructions for type and capacity of each piece of equipment. The Plumbing Contractor shall obtain these instructions from the manufacturer and such instructions shall be considered a part of these specifications. Type, capacity, and application of equipment shall be suitable and capable of satisfactory operation for the purpose intended in the plumbing system.

J. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation, and maintenance.

K. It shall be the responsibility of the Contractor to ensure that the items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connection, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications.

L. Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install that equipment to operate properly and in harmony with the intent of drawings and specifications. When directed by the Architect, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, ductwork, supports, insulation, wiring, heaters, panelboards, etc. He shall provide any additional motors, controllers, valves, fittings, and other additional equipment for the proper operation of the system resulting from the selection of that equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing-in and in connections by other trades. All changes shall be made at no increase in the Contract Amount or additional cost to the other trades.

M. Unless otherwise noted on the drawings or in the specifications, concrete pads and bases for heaters, tanks, and other equipment shall be furnished and installed by the Contractor furnishing the equipment requiring such pad or base. The Contractor shall establish sizes and locations of the various concrete bases required and shall provide all necessary anchor bolts, together with the templates for holding these bolts in position. Anchor bolts shall be placed in steel pipe sleeves to allow for adjustment, with suitable plate at bottom end of sleeve to hold the bolt. Each concrete base shall be not less than 4" high, which shall project 3" on all sides beyond the equipment. Special vibration isolation foundations that are required are specified with the equipment supported.

N. The Contractor shall support, plumb, rigid and true to line, all work and equipment furnished under each section. The Contractor shall study thoroughly all general, structural, mechanical, and electrical drawings, shop drawings, and catalog data to determine how equipment, fixtures, piping, conduit, ductwork, etc. are to be supported, mounted, or suspended and shall provide extra steel bolts, inserts, pipe standards, brackets and accessories for proper support, whether or not shown on the drawings. When directed, the Contractor shall submit prints showing supports for approval.

O. Provide safety guards for all pulleys, belt-drives and rotating equipment. Safety requirements of the Pennsylvania Department of Labor and Industry and OSHA shall be met.

1.26 COORDINATION

A. Sequence of Work

1. Provide in accordance with Division 01 Section SUMMARY.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

E. This Plumbing Contractor must cooperate completely and coordinate work with the General Trade and other trades providing equipment under this division and other divisions of the specifications.

F. Interference drawings shall be prepared as a combined effort of all trades. Each trade shall proceed with their own set of drawings on electronic backgrounds in AutoCAD Format prepared by the Mechanical Contractor. The Mechanical Contractor shall start their drawings immediately upon award of contract. Drawings shall be at 1/4" = 1'0" scale based on sheet size and plan location and orientation as shown on the architectural drawings. All interference drawings shall be capable of being overlaid to coordinate interferences and for printing. All congested areas and mechanical room plans shall be drawn at 3/8" = 1'0" scale.

G. After the Mechanical Contractor has finished, it shall forward one print along with an electronic file to the Plumbing trade that in turn will show and coordinate the plumbing work on the combined plans with the other trades. After the Plumbing trade has finished, it shall forward one print along with an electronic file to the Electrical trade that, in turn, will show and coordinate the electrical work on the combined plans with the other trades. After the Electrical trade has finished, it shall forward one print along with an electronic file to the Plumbing trade that, in turn, will show and coordinate the electrical work on the combined plans with the other trades.

H. Interference plans and elevations shall show in detail the location of the following items which require coordination because of size and proximity to other equipment and systems. Drawings shall show in order of installation priority within the allotted space the items prioritized in the paragraph entitled "Space Priority".

1. In addition, show mechanical and electrical work in equipment rooms.
2. On the interference drawings, show all electrical conduits which are 1-1/2" and larger.

I. Reproducible copies along with electronic file of the finished interference drawings shall be submitted to the Architect for record and approval before actual installation work begins. Each trade shall make completed interference drawings available to their craft for installation of the work.

J. Individual trade interference drawings may be used as shop drawings and/or as record drawings at the completion of the project.

1.27 DEMONSTRATION AND TRAINING

A. Provide in accordance with Division 01 Section DEMONSTRATION AND TRAINING and as stated below.

B. After the tests and adjustments have been made, approved factory-authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment installed under this Contract. Dates and times of such instructions shall be as directed by Owner, including any necessary weekend or after-hours instruction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Company
b. Dresser Industries, Inc.; DMD Division
c. Ford Meter Box Company, Inc. (The); Pipe Products Division
d. JCM Industries
e. Smith-Blair, Inc.
f. Viking Johnson

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. Nibco, Inc.
b. Nibco, Inc.; Chemtrol Division

E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Company
b. Fernco, Inc.
c. Mission Rubber Company
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory fabricated, union assembly, for 250-psig minimum working pressure at 180°F.

1. Manufacturers:

a. Capitol Manufacturing Company
b. Central Plastics Company
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Division
g. Zurn Industries, Inc.; Wilkins Division

D. Dielectric Flanges: Factory fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Company
b. Central Plastics Company
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Division

E. Dielectric Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225°F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corporation

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225°F.

1. Manufacturers:

a. Perfection Corporation
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Company of America

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Company
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Sleeves for Pipes through Non-Fire Rated Walls and Floors: Form with galvanized steel.

F. Sleeves for Pipes through Exterior Masonry and Concrete Walls and Slabs below Grade: Form with schedule 40 steel pipe with water stops.

G. Sleeves for Pipes through Masonry and Concrete Walls and Slabs above Grade: Form with Schedule 40 steel pipe.

H. Sleeves for Pipe through Drywall and Plaster Partitions: Form with galvanized steel.

I. Provide Link-Seal by Thunderline Corporation for below grade piping penetrations through exterior walls and slabs.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome plated finish.

C. One-Piece, Cast brass Type: With set screw.

1. Finish: Polished chrome plated and rough brass.

D. Split-Casting, Cast brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome plated and rough brass.

E. One-Piece, Stamped steel Type: With set screw or spring clips and chrome plated finish.

F. Split-Plate, Stamped steel Type: With concealed hinge, set screw or spring clips, and chrome plated finish.

G. One-Piece, Floor plate Type: Cast iron floor plate.

H. Split-Casting, Floor plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.10 ACCESS PANELS

A. Where required for access to valves, cleanouts, etc., and where new and existing items require adjustments, inspection or service, removable panels complete with frame shall be furnished and installed by this Contractor. Panels shall be of sizes required for their intended service and shall be of the type, fire rating, finish, color and material required for the finish and construction into which they are installed. Coordinate with General Contractor and Architect prior to purchasing.

B. Access panels shall be a minimum of 18" x 18" or larger where needed to remove equipment and allow man access. Doors shall be hinged and removable.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed:

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

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. When demolishing existing equipment, the Plumbing Contractor shall remove all existing piping, insulation, supports, hangers, hanger rods, anchor bolts, structural steel, and concrete pads related to the work being removed. When demolishing piping branch runouts, remove the entire branch which is accessible above lay-in ceilings or accessible during the construction period back to the main, unless otherwise noted. When demolishing equipment and fixtures and the branch runouts are inaccessible, cap, seal, and abandon the branch runouts in an approved manner.

E. Where demolition of work results in unsightly openings in occupied spaces or jeopardizes the integrity of a fire or smoke barrier, the opening shall be patched in accordance with Division 1.

F. Where demolition requires the removal of a concrete equipment pad, remove the pad, cut all anchor bolts, dowel pins, and steel bases off flush with the floor so as to eliminate any tripping hazard. Fill any openings, voids, or holes with a fine cement grout or another appropriate floor patching material. Provide surface finish to match adjacent flooring material.

3.2 CLEANING UP/REMOVAL OF DEBRIS

A. This Contractor shall periodically, and at such times as directed by the Professional, remove from the premises all trash and debris caused by the performance of his work. At the completion of the work, all parts of the plumbing installation shall by thoroughly cleaned by this Contractor. All piping, flush valves, fixtures, trim, strainers, etc., shall be cleaned of all grease, dirt and metal cuttings. All plumbing fixtures shall be cleaned to restore to their original condition.

B. Any damage to the building finishes or furnishings due to the failure of this Contractor to afford proper protection during the execution of his work, shall be restored in a manner satisfactory to the Architect/Owner.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Water piping shall be graded in such a manner as to be completely drain the entire system and to permit air relief of hot water piping systems.

L. Select system components with pressure rating equal to or greater than system operating pressure.

M. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome plated Piping: One-piece, cast brass type with polished chrome plated finish.
    c. Insulated Piping: One-piece, stamped steel type with spring clips.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast brass type with polished chrome plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast brass type with polished chrome plated finish.
    f. Bare Piping in Unfinished Service Spaces: One-piece, cast brass type with polished chrome plated or rough-brass finish.
    g. Bare Piping in Equipment Rooms: One-piece, cast brass type.
    h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor plate type.

2. Existing Piping - use the following:

    a. Chrome plated Piping: Split-casting, cast brass type with chrome plated finish.
    b. Insulated Piping: Split-plate, stamped steel type with concealed hinge and spring clips.
    c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast brass type with chrome plated finish.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel type with concealed hinge and spring clips.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast brass type with chrome plated finish.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel type with concealed hinge and set screw.
    g. Bare Piping in Unfinished Service Spaces: Split-casting, cast brass type with polished chrome plated or rough-brass finish.
    h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel type with concealed or exposed-rivet hinge and set screw or spring clips.
    i. Bare Piping in Equipment Rooms: Split-casting, cast brass type.
    j. Bare Piping in Equipment Rooms: Split-plate, stamped steel type with set screw or spring clips.
    k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor plate type.

N. Sleeves are not required for core-drilled holes.

O. Permanent sleeves are not required for holes formed by removable PE sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

R. Aboveground, Exterior Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Underground, Exterior Wall Pipe Penetrations: Install cast iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

T. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Exposed piping in finished spaces shall be chrome-plated

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Non-pressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain End Pipe and Fittings: Use butt fusion.
2. Plain End Pipe and Socket Fittings: Use socket fusion.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Provide in accordance with Division 01 Section EXECUTION and as stated below.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment to allow right of way for piping installed at required slope.

3.7 STARTING OF PLUMBING SYSTEMS AND EQUIPMENT

A. Provide material and labor required to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures. Refer to the section in Division 22 in which the system or equipment item is specified for specific start-up requirements for that system or equipment item.

3.8 TRAPS

A. Unless otherwise specified or shown on the drawings, all plumbing fixtures, floor drains, and equipment furnished by this or other current contracts shall be individually trapped with full bore traps. Generally, plumbing fixture traps shall be on the wall outlet type connecting to a sanitary tee drainage fitting, the vent being extended vertically and provided with offsets where shown or specified.

B. Traps supplied with the plumbing fixtures are specified elsewhere; however, all equipment furnished under other contracts and requiring waste connections and not furnished with traps, shall be provided with traps furnished and installed by this Contractor. All unburied traps shall be cast brass of the sizes shown on the drawings, and shall, where exposed, be chrome plated and connected to the roughing with chrome plated copper tubing. Buried traps shall be cast iron.

C. Where buried, running traps shall have one vent hub fitted with extension section of pipe to permit cleanout plug to be installed under cover plate, set flush with finished floor. All unburied P-traps shall have cleanout plug on the bottom of the bed of the trap. Buried P-traps shall not have cleanout plugs.

3.9 FLASHING

A. Openings in roofs for extended soil and vent pipe shall be flashed by the General Contractor. Refer to detail on Architectural drawings.

3.10 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.11 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete".

3.12 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.13 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.14 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.15 MATERIALS PROHIBITED

A. Absolutely no materials, equipment, etc., containing asbestos and/or lead shall be installed on this construction project. No deviations will be entertained or accepted.

3.16 CERTIFICATION

A. After a final site observation has been performed by the engineer, the contractor shall provide the Owner with a letter certifying that he did not install any asbestos-containing and/or lead containing materials on this project a result of his construction work. In addition, the contractor shall provide the owner with a letter from each of his sub-contractors certifying the same.

3.17 GUARANTEE OF WORK

A. Where applicable, furnish manufacturer's written warranty for materials and equipment.

B. Comply, also, with the General Conditions and the Supplementary Conditions and the applicable Section of Division 1, General Requirements.

C. This Plumbing Contractor shall furnish a written warranty stating that all work shall be free from defects of equipment, material for workmanship for a period of one year from date of final acceptance and all defects developing during that period shall be made good without cost to the Owner.

D. This Plumbing Contractor shall service the installation for one year from date of final acceptance. This shall include all emergency service and adjustment, with the exception of the oiling of motors and cleaning of filters and screens.

3.18 FINAL PLUMBING CONNECTIONS

A. Provide rough-in and final connection of all Plumbing services needed for equipment provided by the Owner or by other trades. Shop Drawings will be furnished by those providing the equipment. These Drawings shall be checked by the trade responsible for rough-in and final connections before submission to the Architect for approval. The work shall be done in accordance with the approved Shop Drawings.

B. In general, connection and termination points are given in the Contract Documents. Where not given or where conflicts occur, refer the question to the Architect for a binding decision.

END OF SECTION 22 0500

SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

B. Motors shall be furnished with equipment requiring same. Unless hereinafter specifically specified or specifically noted on the drawings, all motors 1/2 HP and larger shall be designed for three phase, 60 cycle alternating current at 208/480 volts, as scheduled on the drawings. Motors smaller than 1/2 HP shall be designed for single phase, 60 hertz alternating current at 120 volts. Refer to Equipment Schedules on the drawings for specific motor requirements for all equipment.

C. Combination motor starters and disconnect switches, and control devices shall be furnished with each motor as required and as hereinafter specified for each particular motor.

D. Combination motor starters and disconnect switches will be furnished by the Plumbing Contractor and installed by the Contractor for Electrical Work, unless specifically noted otherwise on the drawings.

E. All fuses shall be "Fusetron" or approved equal.

F. The Electrical Contractor shall be responsible for proper direction of rotation of all three phase equipment.

G. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not over 18" long.

H. All equipment shall be grounded with a green-covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end.

I. All electrical work required in the Mechanical Contracts shall conform to all applicable requirements of Division 26 of these Specifications.

J. The Plumbing Contractor shall employ an approved sub-contractor, fully qualified in the trade, to perform all Electrical Work required under the Plumbing Contract.

The Plumbing Contractor shall cooperate with the Contractor for Electrical Work in making all necessary tests and in receiving, storing and setting all motor driven equipment, electrical devices, and controls furnished and/or installed under these Contracts.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40°C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse width modulated inverters.
2. Energy and Premium Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

D. Three phase equipment controls and wiring shall be as follows:

1. Plumbing Contractor shall furnish and install all control devices, such as contactors, motor starters, thermal and overload protection, pushbuttons, thermostats, etc.
2. Plumbing Contractor shall furnish and install all controls and control wiring from control devices to motor starters and contactors and between control devices.
3. Electrical Contractor will furnish and install all power wiring and conduit to motor starters, contactors, and disconnect switches, and between starters and contactors and motor or other load.

2.5 SINGLE PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

F. Single phase equipment controls and wiring shall be as follows:

1. Plumbing Contractor shall furnish and install all control devices, such as motor sentinel switches, thermostats, etc.
2. Plumbing Contractor shall furnish and install all conduit and control wiring from control devices to junction box or to disconnect switch mounted on unit.
3. Electrical Contractor will furnish and install all power wiring and conduit to junction box or to disconnect switch on unit.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 0513

SECTION 22 0519 - METERS AND GAUGES FOR PLUMBING 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. Thermometers.
2. Gauges.
3. Test plugs.

B. Related Sections:

1. Division 22 Section 22 1116 "Domestic Water Piping" for domestic and fire protection water service meters inside the building.
2. Division 22 Section 22 6100 "Facility Natural Gas Piping" for gas meters.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gauges indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer and gauge, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 METAL CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Palmer - Wahl Instruments Inc.
2. Trerice, H. O. Company
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Division

B. Case: Die-cast aluminum, 9 inches long.

C. Tube: Red or blue reading, mercury or organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, non-reflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic.

F. Connector: Adjustable type, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus, or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 DIRECT MOUNTING, VAPOR ACTUATED DIAL THERMOMETERS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Division
2. Trerice, H. O. Company
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Division

B. Case: Liquid-filled type, cast aluminum, 4-1/2 inch diameter.

C. Element: Bourdon tube or other type of pressure element.

D. Movement: Mechanical, connecting element and pointer.

E. Dial: Satin-faced, non-reflective aluminum with permanently etched scale markings.

F. Pointer: Red or other dark-color metal.

G. Window: Glass or plastic.

H. Ring: Metal.

I. Connector: Adjustable type, 360 degrees in horizontal plane, with locking device.

J. Thermal System: Liquid- or mercury-filled bulb in copper plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.

K. Accuracy: Plus, or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Division
2. Palmer - Wahl Instruments Inc.
3. Trerice, H. O. Company
4. Weiss Instruments, Inc.
5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Division

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAUGES

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Division
2. Palmer - Wahl Instruments Inc.
3. Trerice, H. O. Company
4. Weiss Instruments, Inc.
5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Division

B. Direct Mounting, Dial type Pressure Gauges: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, non-reflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic.
8. Ring: Metal.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure Gauge Fittings:

1. Valves: NPS 1/4 (DN 8) brass or stainless steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Company
3. National Meter, Inc.
4. Peterson Equipment Company, Inc.
5. Sisco Manufacturing Company
6. Trerice, H. O. Company
7. Watts Industries, Inc.; Water Products Division

B. Description: Corrosion-resistant brass or stainless steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating**:** 500 psig at 200°F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20° to 200°F shall be CR.
2. Insert material for water service at -30° to +275°F shall be EPDM.

E. Test Kit: Furnish one test kit containing one pressure gauge and adaptor, two thermometer(s), and carrying case. Pressure gauge, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gauge: Small bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low Range Thermometer: Small bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial ranges shall be 25° to 125°F.
   High Range Thermometer: Small bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial ranges shall be 0° to 220°F.
3. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the outlet of each domestic, hot water storage tank.

B. Install liquid-filled-case-type, vapor-actuated dial thermometers at suction and discharge of each pump.

C. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30° to 180°F, with 2-degree scale divisions.
2. Domestic Cold Water: 0° to 100°F, with 2-degree scale divisions.

3.2 GAUGE APPLICATIONS

A. Install dry case type pressure gauges for discharge of each pressure-reducing valve.

B. Install dry case type pressure gauges at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid or to center of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct mounting pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

D. Install needle valve and snubber fitting in piping for each pressure gauge.

E. Install test plugs in tees in piping.

F. Install permanent indicators on walls or brackets in accessible and readable positions.

G. Install connection fittings for attachment to portable indicators in accessible locations.

H. Install thermometers and gauges adjacent to machines and equipment to allow service and maintenance for thermometers, gauges, machines, and equipment.

I. Adjust faces of thermometers and gauges to proper angle for best visibility.

END OF SECTION 22 0519

SECTION 22 0523 - GENERAL - DUTY VALVES FOR PLUMBING 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 the following general-duty valves:

1. Copper alloy ball valves.
2. Ferrous alloy ball valves.
3. Bronze check valves.
4. Gray iron swing check valves.
5. Ferrous alloy wafer check valves.
6. Spring loaded, lift disc check valves.
7. Bronze gate valves.
8. Cast iron gate valves.
9. Cast iron plug valves.

B. Products furnished for this project shall be “LEAD FREE” as required by Federal legislation passed on January 4, 2011. This entails the wetted surfaces of plumbing fixtures, equipment, valves, etc. described in this section to have a weighted-average lead content of no more than 0.25% when used in applications intended to convey or dispense water for human consumption through drinking or cooking.

C. Related Sections include the following:

1. Division 22 Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and charts.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES - GENERAL

A. Refer to Part 3 "Valve Applications" article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valves shall be of the “LEAD FREE” design.

G. Valve Actuators:

1. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Hand wheel: For valves other than quarter-turn types.
3. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

H. Extended Valve Stems: On insulated valves.

I. Valve Flanges: ASME B16.1 for cast iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

J. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840°F for angle, check, gate, and globe valves; below 421°F for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

K. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER ALLOY BALL VALVES

A. Manufacturers

1. Two-Piece, Copper alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Division
b. Crane Company; Crane Valve Group; Stockham Division
c. Grinnell Corporation
d. Hammond Valve
e. Milwaukee Valve Company
f. Nibco, Inc.
g. Watts Industries, Inc.; Water Products Division

B. Two-Piece, Copper alloy Ball Valves: Bronze body with regular-port, chrome plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

2.4 FERROUS ALLOY BALL VALVES

A. Manufacturers:

1. Conbraco Industries, Inc.; Apollo Division
2. Crane Company; Crane Valve Group; Stockham Division
3. Hammond Valve
4. Milwaukee Valve Company
5. Nibco, Inc.

B. Ferrous alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous alloy Ball Valves: Class 300, full or regular port.

2.5 BRONZE CHECK VALVES

A. Manufacturers

1. Type 3, Bronze, Swing Check Valves with Metal Disc:

a. Cincinnati Valve Company
b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation
d. Hammond Valve
e. Milwaukee Valve Company
f. Nibco, Inc.
g. Watts Industries, Inc.; Water Products Division

2. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:

a. Cincinnati Valve Company
b. Crane Company; Crane Valve Group; Stockham Division
c. Grinnell Corporation
d. Hammond Valve
e. Milwaukee Valve Company
f. Nibco, Inc.
g. Watts Industries, Inc.; Water Products Division

B. Bronze Check Valves, General: MSS SP-80.

C. Type 3, Class 200, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

D. Type 4, Class 200, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.6 GRAY IRON SWING CHECK VALVES

A. Manufacturers

1. Type I, Gray iron Swing Check Valves with Metal Seats:

a. Cincinnati Valve Company
b. Crane Company; Crane Valve Group; Stockham Division
c. Grinnell Corporation
d. Hammond Valve
e. Milwaukee Valve Company
f. Mueller Company
g. Nibco, Inc.
h. Watts Industries, Inc.; Water Products Division

2. Type II, Gray iron Swing Check Valves with Composition to Metal Seats:

a. Crane Company; Crane Valve Group; Stockham Division
b. Mueller Company
c. Watts Industries, Inc.; Water Products Division

3. Grooved End, Ductile-Iron Swing Check Valves:

a. Grinnell Corporation
b. Mueller Company
c. Victaulic Company of America

B. Gray iron Swing Check Valves, General: MSS SP-71.

C. Type I, Class 250, gray iron, swing check valves with metal seats.

D. Type II, Class 250, gray iron, swing check valves with composition to metal seats.

E. 300-psig CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.7 SPRING LOADED, LIFT DISC CHECK VALVES

A. Manufacturers

1. Type II, Compact Wafer, Lift disc Check Valves:

    a. Grinnell Corporation
    b. Hammond Valve
    c. Milwaukee Valve Company
    d. Mueller Steam Specialty
    e. Nibco, Inc.

2. Type III, Globe Lift disc Check Valves:

    a. Grinnell Corporation
    b. Hammond Valve
    c. Milwaukee Valve Company
    d. Nibco, Inc.

3. Type IV, Threaded Lift disc Check Valves:

    a. Grinnell Corporation
    b. Milwaukee Valve Company
    c. Mueller Steam Specialty
    d. Nibco, Inc.
    e. Watts Industries, Inc.; Water Products Division

B. Lift disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Type II, Class 250, Compact-Wafer, Lift disc Check Valves: Compact-wafer style with cast iron shell with diameter made to fit within bolt circle.

D. Type III, Class 250, Globe Lift disc Check Valves: Globe style with cast iron shell and flanged ends.

E. Type IV, Class 150, Threaded Lift disc Check Valves: Threaded style with bronze shell and threaded ends.

2.8 BRONZE GATE VALVES

A. Manufacturers

1. Type 1, Bronze, Non-rising Stem Gate Valves:

    a. Cincinnati Valve Company
    b. Crane Company; Crane Valve Group; Stockham Division
    c. Grinnell Corporation
    d. Hammond Valve
    e. Milwaukee Valve Company
    f. Nibco, Inc.
    g. Watts Industries, Inc.; Water Products Division

2. Type 2, Bronze, Rising Stem, Solid-Wedge Gate Valves:

    a. Cincinnati Valve Company
    b. Crane Company; Crane Valve Group; Stockham Division
    c. Grinnell Corporation
    d. Hammond Valve
    e. Milwaukee Valve Company
    f. Nibco, Inc.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous alloy handwheel.

C. Type 1, Class 200, Bronze Gate Valves: Bronze body with non-rising stem and bronze solid wedge and union-ring bonnet.

D. Type 2, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

2.9 CAST IRON GATE VALVES

A. Manufacturers

1. Type I, Cast-iron, non-rising stem Gate Valves:

    a. Cincinnati Valve Company
    b. Crane Company; Crane Valve Group; Stockham Division
    c. Grinnell Corporation.
    d. Hammond Valve.
    e. Milwaukee Valve Company.
    f. Nibco, Inc.
    g. Watts Industries, Inc.; Water Products Division

2. Type I, cast-iron, Rising-Stem Gate Valves:

    a. Cincinnati Valve Company
    b. Crane Company; Crane Valve Group; Stockham Division
    c. Grinnell Corporation.
    d. Hammond Valve.
    e. Milwaukee Valve Company.
    f. Nibco, Inc.
    g. Watts Industries, Inc.; Water Products Division

B. Cast iron Gate Valves, General: MSS SP-70, Type I.

C. Class 250, NRS, Bronze mounted, cast-iron Gate Valves: Cast iron body with bronze trim, non-rising stem, and solid-wedge disc.

D. Class 250, OS&Y, Bronze mounted, cast-iron Gate Valves: Cast iron body with bronze trim, rising stem, and solid-wedge disc.

E. Class 250, NRS, All-Iron, Cast-Iron Gate Valves: Cast iron body with cast iron trim, non-rising stem, and solid-wedge disc.

F. Class 250, OS&Y, All-Iron, Cast-Iron Gate Valves: Cast iron body with cast iron trim, rising stem, and solid-wedge disc.

2.10 CAST IRON PLUG VALVES

A. Manufacturers

1. Lubricated Type, Cast iron Plug Valves:

a. Milliken Valve Company, Inc.
b. Nordstrom Valves, Inc.
c. Olson Technologies; Homestead Division
d. R & M Energy Systems (Tomball, TX).
e. Walworth Company

B. Cast iron Plug Valves, General: MSS SP-78.

C. Class 250 or 300, lubricated type, cast iron plug valves.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Throttling Service: Ball.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

1. Cast-iron.

C. Domestic Water Piping - use the following types of valves with “LEAD FREE” design:

1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 300, ferrous alloy.
3. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 200, bronze.
4. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 250, gray iron.
5. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: 300-psig CWP rating.
6. Spring-Loaded, Lift disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 125 minimum 200.
7. Spring-Loaded, Lift disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II or III, Class 250, cast iron.
8. Gate Valves, NPS 2 (DN 50) and Smaller: Type 1 or 2, Class 200, bronze.
9. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 250, NRS, bronze mounted cast iron.
10. Plug Valves, NPS 2 (DN 50) and Larger: Class 250 or 300, lubricated-type with FDA-approved-material sealant, cast iron.

D. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section 22 0500 "Common Work Results for Plumbing" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 22 0523

SECTION 22 0529 - HANGERS AND SUPPORTS 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 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product data for the following:

1. Steel pipe hangers and supports.
2. Thermal hanger shield inserts.
3. Powder actuated fastener systems.
4. Pipe positioning systems.

B. Welding certificates.

1.6 QUALITY ASSURANCED

A. Welding - qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory fabricated components. Refer to Part 3 "Hanger and Support Applications" article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports
3. B-Line Systems, Inc.; a division of Cooper Industries
4. ERICO/Michigan Hanger Company
5. Globe Pipe Hanger Products, Inc.
6. Grinnell Corporation
7. National Pipe Hanger Corporation
8. PHD Manufacturing, Inc.
9. PHS Industries, Inc.
10. Piping Technology & Products, Inc.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field fabricated pipe support assembly made from structural steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field fabricated pipe support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries
2. ERICO/Michigan Hanger Co.; ERISTRUT Division
3. Power-Strut Division; Tyco International, Ltd.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Company
2. PHS Industries, Inc.
3. Pipe Shields, Inc.

C. Insulation Insert Material for Cold Piping: Water repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

D. Insulation Insert Material for Hot Piping: Water repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. Powers Fasteners.

B. Mechanical Expansion Anchors: Insert-wedge-type zinc coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries
b. Hilti, Inc.
c. ITW Ramset/Red Head
d. Powers Fasteners

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field fabricated assemblies made of manufactured corrosion-resistant components to support roof mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Company
b. MIRO Industries

C. Low type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:

a. MIRO Industries

D. High Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Company
b. MIRO Industries
c. Portable Pipe Hangers

2. Base: Plastic or Stainless steel.
3. Vertical Members: Two or more cadmium plated steel or stainless steel, continuous-thread rods.
4. Horizontal Member: Cadmium plated steel or stainless steel rod with plastic or stainless steel, roller-type pipe support.

E. High Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective coated steel channels.
4. Horizontal Member: Protective coated steel channel.
5. Pipe Supports: Galvanized steel, clevis type pipe hangers.

F. Curb Mounting Type Pipe Stands: Shop or field fabricated pipe support made from structural steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corporation
2. HOLDRITE Corp.; Hubbard Enterprises
3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal Piping Hangers and Supports - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120° to 450°F pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical Piping Clamps - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger Rod Attachments - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120° to 450°F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120° to 450°F piping installations.

I. Building Attachments - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder actuated fasteners or mechanical expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded structural steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in

direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping - comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe - not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
    b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 22 0529

SECTION 22 0553 - 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 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels
2. Warning signs and labels
3. Pipe labels
4. Valve tags
5. Warning tags

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless steel rivets or self-tapping screws.
5. Adhesive: Contact type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black or White, opposite of background color.
3. Background Color: Black or White.
4. Maximum Temperature: Able to withstand temperatures up to 160°F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 x 11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch, stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule

1. Cold Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Hot Water Supply Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3. Hot Water Re-circulation Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

4. Natural Gas Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.4 VALVE TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory fabricated equipment units; shutoff valves; faucets; convenience and lawn watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve Tag Application Schedule - tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve Tag Size and Shape:

   a. Cold Water: 2 inches round.
   b. Hot Water: 2 inches round.

2. Valve Tag Color:

   a. Cold Water: Green.
   b. Hot Water: Green.

3. Letter Color:

   a. Cold Water: White.
   b. Hot Water: White.

3.5 WARNING TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 0553

SECTION 22 0700 - PLUMBING 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

1. Insulation Materials:

a. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Lagging adhesives.
5. Sealants.
6. Factory applied jackets.
7. Tapes.
8. Securements.
9. Corner angles.

B. Related Sections include the following:

1. Division 23 Section 23 0700 "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets.

B. Qualification Data: For qualified Installer.

C. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire Test Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.
2. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

1.5 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.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field applied jackets and finishes and for space required for maintenance.

1.7 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 Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral Fiber, Preformed Pipe Insulation:

1. Products - subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000(Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.

2. Type I, 850°F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory applied ASJ. Factory applied jacket requirements are specified in "Factory Applied Jackets" article.

G. Mineral Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100°F is 0.29 Btu x in./h x sq. ft. x degree F or less. Factory applied jacket requirements are specified in "Factory Applied Jackets" article.

1. Products - subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral Fiber Insulating Cement: Comply with ASTM C 195.

1. Products - subject to compliance with requirements, provide one of the following:

a. Insulco, Division of MFS, Inc.; Triple I.
b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Mineral fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products - subject to compliance with requirements, provide one of the following:

a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 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. Mineral fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products - subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products - subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Red Devil, Inc.; Celulon Ultra Clear.
e. Speedline Corporation; Speedline Vinyl Adhesive.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products - subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-52.
    b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    c. Marathon Industries, Inc.; 130.
    d. Mon-Eco Industries, Inc.; 11-30.
    e. Vimasco Corporation; 136.

2. Fire-resistant, water based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
3. Service Temperature Range: Minus 50° to plus 180°F.
4. Color: White.

2.5 SEALANTS

A. Metal Jacket Flashing Sealants

1. Products - subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-76-8.
    b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Service Temperature Range: Minus 40° to plus 250°F.
4. Color: Aluminum.

B. PVC Jacket Flashing Sealants

1. Products - subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire and water resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40° to plus 250°F.
5. Color: White.

2.6 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. 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. Products - subject to compliance with requirements, provide one of the following:

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   b. Compac Corp.; 104 and 105.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.8 SECUREMENTS

A. Band:

1. Products - subject to compliance with requirements, provide one of the following:

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products - subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products - subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

a. C & F Wire
b. Childers Products
c. PABCO Metals Corporation
d. RPR Products, Inc.

2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Hand holes.
6. Cleanouts.
7. Gas Piping.

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 below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,
   Install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe, and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

   a. Do not weld anchor pins to ASME-labeled pressure vessels.
   b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
   c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.

d. Do not over compress insulation during installation.
e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
f. Impale insulation over anchor pins and attach speed washers.
g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch pre-stressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch pre-stressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, hand holes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, hand holes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum, at least 0.050 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (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.

3.7 MINERAL FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor barrier mastic and joint sealant.
3. For insulation with factory applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FINISHES

A. Equipment and Pipe Insulation with Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.9 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. Inspect field insulated equipment, randomly selected by Architect, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" article. For large equipment, remove only a portion adequate to determine compliance.

2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE - GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated - unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot, Steam and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes - insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 22 0700

SECTION 22 1116 - DOMESTIC WATER 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 domestic water piping inside the building.

B. Related Sections include the following:

1. Division 22 Section 22 0519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and fittings.
2. Division 22 Section 22 1119 "Domestic Water Piping Specialties" for water distribution piping specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig (860 kPa), unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in Part 3 "Cleaning" article.

C. Field quality control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

D. For the installation of ProPress Systems:

1. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of ProPress copper press joint systems.
2. ProPress copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer.
3. The installation of copper tubing for hot and cold water distribution systems shall conform to the requirements of the ICC International Plumbing Code.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
3. Gray iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
4. Cast iron Flanges: ASME B16.1, Class 125.
5. Cast iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
6. Steel-Piping, Grooved-End Fittings: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106, galvanized steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.

    a. Grooved-End-Pipe Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

7. Steel Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome plated finish on slip-pipe sections, and flanged ends.
8. Steel Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome plated finish on slip-pipe sections, and flanged ends.

2.4 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast copper alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Press Fittings: Copper and copper alloy press fittings shall conform to ASME B16.18 or ASME B16.22 and performance criteria of IAMPO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have SC (Smart Connect) feature design (leakage path). In ProPress ½" to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation. Viega press-fittings only.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
4. Copper Unions: MSS SP-123, cast copper alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

    a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.5 VALVES

A. Bronze and cast iron, general duty valves are specified in Division 22 Section 22 0523 "General-Duty Valves for Plumbing Piping".

B. Balancing and drain valves are specified in Division 22 Section 22 1119 "Domestic Water Piping Specialties".

C. Valves shall be of the “LEAD FREE” design.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Above ground Domestic Water Piping: Use any of the following piping materials for each size range:

1. NPS 1 (DN 25) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
2. NPS 1 (DN 25) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and pressed joints. Viega only.
3. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

4. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Hard copper tube, Type L (Type B); copper pressure fittings; and pressed joints. Viega only.
5. NPS 2 (DN 50): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
6. NPS 2 (DN 50): Hard copper tube, Type L (Type B); copper pressure fittings; and pressed joints. Viega only.
7. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
8. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Hard copper tube, Type L (Type B); copper pressure fittings; and pressed joints. Viega only.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot Water Piping, Balancing Duty: Calibrated or Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Cast iron, grooved end valves may be used with grooved-end piping.

C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose end drain valves at low points in water mains, risers, and branches.
2. Install stop and waste drain valves where indicated.

E. Install balancing valve in each hot water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Balancing valves are specified in Division 22 Section 22 1119 "Domestic Water Piping Specialties."

F. Install calibrated balancing valves in each hot water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section 22 1119 "Domestic Water Piping Specialties."

G. Valves shall be of the “LEAD FREE” design.

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

B. Install under building slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install cast iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

E. Install shutoff valve, hose end drain valve, strainer, pressure gauge, and test tee with valve, inside the building at each domestic water service entrance. Pressure gauges are specified in Division 22 Section 22 0519 "Meters and Gauges for Plumbing Piping," and drain valves and strainers are specified in Division 22 Section 22 1119 "Domestic Water Piping Specialties."

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Press Connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs - according to the following:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2 (DN 40): 108 inches with 3/8-inchrod.
3. NPS 2 (DN 50): 10 feet with 3/8-inchrod.
4. NPS 2-1/2 (DN 65): 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet with 5/8-inch rod.
7. NPS 6 (DN 150): 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet with 7/8-inch rod.

F. Install supports for vertical steel piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.
4. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.
6. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
7. NPS 8 (DN 200): 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water service piping with shutoff valve, and extend and connect to the following:

1. Water Heaters: Cold water supply and hot water outlet piping in sizes indicated, but not smaller than sizes of
2. Equipment: Cold and hot water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot water circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 1116

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

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 the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Strainers.
5. Outlet boxes.
6. Hose bibbs.

B. Products furnished for this project shall be “LEAD FREE” as required by Federal legislation passed on January 4, 2011. This entails the wetted surfaces of plumbing fixtures, equipment, valves, etc. described in this section to have a weighted average lead content of no more than 0.25% when used in applications intended to convey or dispense water for human consumption through drinking or cooking.

C. Related Sections include the following:

1. Division 22 Section 22 0519 "Meters and Gauges for Plumbing Piping" for thermometers and pressure gauges in domestic water piping.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 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. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe Applied, Atmospheric Type Vacuum Breakers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Ames Company
    b. Conbraco Industries, Inc.
    c. Watts Industries, Inc.; Water Products Division
    d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose Connection Vacuum Breakers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Legend Valve
    c. Watts Industries, Inc.; Water Products Division
    d. Woodford Manufacturing Company
    e. Zurn Plumbing Products Group; Light Commercial Operation
    f. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1011.
3. Body: Bronze, non-removable, with manual drain.
4. Outlet Connection: Garden hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Ames Company
    b. Conbraco Industries, Inc.
    c. Watts Industries, Inc.; Water Products Division
    d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1020.
3. Operation: Continuous pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

D. Laboratory Faucet Vacuum Breakers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Division
    c. Woodford Manufacturing Company
    d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1035.
3. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10) matching faucet size.
4. Body: Bronze.
5. End Connections: Threaded.
6. Finish: Chrome plated.

E. Spill Resistant Vacuum Breakers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Division

2. Standard: ASSE 1056.
3. Operation: Continuous pressure applications.
4. Size: NPS 3/4 (DN 20).
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric Vent Backflow Preventers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Legend Valve.
    c. Watts Industries, Inc.; Water Products Division
    d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1012.
3. Product shall be of the “LEAD FREE” design.
4. Operation: Continuous pressure applications.
5. Size: NPS 1/2 (DN 15) or NPS 3/4 (DN 20).
6. Body: Bronze.
7. End Connections: Union, solder joint.
8. Finish: Chrome plated.

B. Reduced Pressure Principle Backflow Preventers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Ames Company
    b. Conbraco Industries, Inc.
    c. Watts Industries, Inc.; Water Products Division
    d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1013.
3. Product shall be of the "LEAD FREE" design.
4. Operation: Continuous pressure applications.
5. Pressure Loss: 6 psig (83 kPa) maximum, through middle 1/3 of flow range.
6. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
7. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
    b. Air Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double Check Backflow Prevention Assemblies:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Ames Company
    b. Conbraco Industries, Inc.
    c. Watts Industries, Inc.; Water Products Division
    d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1015.
3. Product shall be of the "LEAD FREE" design.
4. Operation: Continuous pressure applications, unless otherwise indicated.
5. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
6. Body: Bronze for NPS 2 (DN 50) and smaller**;** cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
7. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

D. Dual Check Valve Backflow Preventers:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Legend Valve.
    c. Mueller Co.; Water Products Division
    d. Watts Industries, Inc.; Water Products Division
    e. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1024.

3. Product shall be of the “LEAD FREE” design.
4. Operation: Continuous-pressure applications.
5. Size: NPS 1/2 (DN 15) thru NPS 1-1/4 (DN 32).
6. Body: Bronze with union inlet.

2.3 BALANCING VALVES

A. Copper Alloy Calibrated Balancing Valves:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Industries; Bell & Gossett Division
    d. Nibco Inc.
    e. TAC Americas
    f. Taco, Inc.
    g. Watts Industries, Inc.; Water Products Division

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Product shall be of the “LEAD FREE” design.
4. Body: Brass or bronze,
5. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
6. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast Iron Calibrated Balancing Valves:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Industries; Bell & Gossett Division
    d. Nibco Inc.
    e. TAC Americas.
    f. Watts Industries, Inc.; Water Products Division

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Product shall be of the “LEAD FREE” design.
4. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory Stop Balancing Valves:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Crane Co.; Crane Valve Group; Stockham Division
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. Nibco Inc.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Product shall be of the “LEAD FREE” design.
4. Pressure Rating: 400-psig (2760-kPa) minimum CWP.

5. Size: NPS 2 (DN 50) or smaller.
6. Body: Copper alloy.
7. Port: Standard or full port.
8. Ball: Chrome plated brass.
9. Seats and Seals: Replaceable.
10. End Connections: Solder joint or threaded.
11. Handle: Vinyl covered steel with memory-setting device.

E. Individual Fixture, Water Tempering Valves (To be provided under all lavatories and sinks):

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company
   d. Powers; a Watts Industries Company
   e. Watts Industries, Inc.; Water Products Division
   f. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
3. Product shall be of the "LEAD FREE" design.
4. Pressure Rating: 125 psig minimum, unless otherwise indicated.
5. Body: Brass body with corrosion-resistant interior components.
6. Temperature Control: Adjustable.
7. Inlets and Outlet: Threaded.
8. Finish: Rough or chrome plated bronze.
9. Model 7-210-CK "Maxline" manufactured by Symmons.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. Product shall be of the "LEAD FREE" design.
4. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
5. Screen: Stainless steel with round perforations, unless otherwise indicated.
6. Drain: Factory installed; hose end drain valve.

2.5 OUTLET BOXES

A. Icemaker Outlet Boxes

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. Acorn Engineering Company
   b. IPS Corporation
   c. LSP Products Group, Inc.
   d. Oatey
   e. Plastic Oddities; a division of Diverse Corporate Technologies

2. Mounting: Recessed.
3. Product shall be of the "LEAD FREE" design.

4. Material and Finish: Enameled steel or epoxy painted steel or plastic box and faceplate.
5. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 (DN 15) or smaller copper tube outlet.
6. Supply Shutoff Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral**,** non-removable, drainable, hose connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating key hose bibb.
15. Include integral wall flange with each chrome or nickel plated hose bibb.

2.7 DRAIN VALVES

A. Ball Valve Type, Hose End Drain Valves

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate Valve Type, Hose End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.
6. Outlet: Garden hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.

3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Josam Company.
   c. PPP Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Division
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section 22 0500 "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air gap fitting, fixed air gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet type units recessed in or surface mounted on wall as specified.

E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

F. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire retardant treated wood blocking is specified in Division 06 Section "Rough Carpentry."

G. Install water hammer arresters in water piping according to PDI-WH 201.

H. Install supply type, trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section 26 0526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section 26 0519 "Low Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs - install engraved plastic laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric vent backflow preventers.
3. Reduced pressure principle backflow preventers.
4. Double check backflow prevention assemblies.
5. Dual check valve backflow preventers.
6. Calibrated balancing valves.
7. Outlet boxes.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced pressure principle backflow preventer and double check backflow prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field adjustable flow set points of balancing valves.

END OF SECTION 22 1119

SECTION 22 1316 - SANITARY WASTE AND VENT 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 the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections include the following:

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Sanitary Sewer, Force-Main Piping: 100 psig.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

C. Cast Iron soil pipe and fittings shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast iron aerator and deaerator drainage fittings.

C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy Duty, Shielded, Stainless steel Couplings: Heavy Duty Couplings shall conform to CISPI 310 and ASTM C 1277. Shield Assemblies shall consist of a stainless steel bi-directional corrugated shield; stainless steel bands and tightening devices; and an ASTM C 564, rubber sleeve with integral center stop. Couplings shall bear the NSF Trademark, and be manufactured in the USA.
2. Manufacturers:

    a. Clamp-All Corporation
    b. Husky
    c. Mission Rubber Company
    d. Tyler Pipe; Soil Pipe Division

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

2.5 PVC PIPE AND FITTINGS (UNDERGROUND ONLY)

A. Solid Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.6 SPECIAL PIPE FITTINGS

A. Flexible, Non-pressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion resistant metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Dallas Specialty & Mfg. Company
b. Fernco, Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Company
e. NDS, Inc.

2. Sleeve Materials:

a. For Cast iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Non-pressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Company
b. Mission Rubber Company

C. Rigid, Unshielded, Non-pressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. ANACO

D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Company
b. Dresser, Inc.; DMD Division
c. EBAA Iron Sales, Inc.
d. Ford Meter Box Company, Inc. (The); Pipe Products Division
e. JCM Industries, Inc.
f. Romac Industries, Inc.
g. Smith-Blair, Inc.
h. Viking Johnson

2. Center-Sleeve Material: Manufacturer's standard.
3. Gasket Material: Natural or synthetic rubber.
4. Metal Component Finish: Corrosion-resistant coating or material.

E. Flexible Ball Joints: Ductile iron fitting with combination of flanged and mechanical joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball joint section and ductile iron gland, rubber gasket, and steel bolts.

1. Manufacturers:

a. EBAA Iron Sales, Inc.

F. Expansion Joints: Two or three-piece, ductile iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

a. EBAA Iron Sales, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products; Star Fittings Division

G. Wall Penetration Fittings: Compound, ductile iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

a. SIGMA Corporation

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, cross-laminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.

B. Form: Sheet or tube.

C. Color: Black or natural.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Dissimilar Pipe Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.
2. Dissimilar Pipe-Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Dissimilar Pipe Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.
2. Dissimilar Pipe Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

F. Underground buried within 5’ of the building, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

G. Underground buried within 5’ of the building, soil and waste piping NPS 5 (DN 125) and larger shall be the following:

1. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

D. Install underground, ductile iron, force-main piping according to AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

E. Install underground, ductile iron, special pipe fittings according to AWWA C600.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

F. Install cast iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

G. Install wall penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

H. Install cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

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 2 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. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. 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 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping (2-1/2” and less): 2 percent downward in direction of flow.
3. Horizontal Sanitary Drainage Piping (3” and larger): 1 percent downward in direction of flow.
4. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Sleeves are not required for cast iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

B. Join hubless cast iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless coupling joints.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch rod.
2. NPS 3 (DN 80): 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches with 5/8-inch rod.
4. NPS 6 (DN 150): 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches with 7/8-inch rod.

F. Install supports for vertical cast iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.
3. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.
5. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
6. NPS 8 (DN 200): 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.7 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. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). 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 (250 Pa). 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

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 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 1316

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

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 the following sanitary drainage piping specialties:

1. Through penetration firestop assemblies.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Shop Drawings:

B. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 THROUGH PENETRATION FIRESTOP ASSEMBLIES

A. Through penetration Firestop Assemblies:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Special Coating: Corrosion resistant on interior of fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section 22 0500 "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install through penetration firestop assemblies in plastic conductors at floor penetrations.

C. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons if required to conceal protruding pipe fittings.

3.2 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.

C. Ground equipment according to Division 26 Section 26 0526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section 26 0519 "Low Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 PROTECTION

A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319

SECTION 23 2213 - STEAM 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 pipe and fittings for LP steam piping:

1.3 ACTION SUBMITTALS

A. Product Data: For RTRP and RTRF and adhesive.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding - qualify procedures and operators according to the following:

1. ASME Compliance: Comply with ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in piping applications articles.

C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in piping applications articles.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.

E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in piping applications articles; raised ground face, and bolt holes spot faced.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

D. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

PART 3 - EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

A. LP Steam Piping, NPS 2 (DN 50) and Smaller: Schedule 40, Type S, steel pipe; Class 125 cast-iron fittings; and threaded joints.

B. LP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300) Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.2 ANCILLARY PIPING APPLICATIONS

A. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

B. Vacuum-Breaker Piping: Outlet, same as service where installed.

C. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) full port-ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

K. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.

L. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

M. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

N. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

O. Install shutoff valve immediately upstream of each dielectric fitting.

P. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 HANGERS AND SUPPORTS

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 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.

B. Install hangers for steel steam supply piping with the following maximum spacing:

1. NPS 3/4 (DN 20): Maximum span, 9 feet.
2. NPS 1 (DN 25): Maximum span, 9 feet.
3. NPS 1-1/2 (DN 40): Maximum span, 12 feet.
4. NPS 2 (DN 50): Maximum span, 13 feet.
5. NPS 2-1/2 (DN 65): Maximum span, 14 feet.
6. NPS 3 (DN 80) and Larger: Maximum span, 15 feet.

C. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes 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. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply piping connections shall be the same as or larger than equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

3.7 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping," and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

E. Prepare test and inspection reports.

END OF SECTION 23 2213

SECTION 22 3300 - ELECTRIC STEAM BOILER

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 the following electric steam boilers:

1. Electric steam boilers.
2. Accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of steam boiler indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For electric steam boilers to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric steam boilers through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric steam boilers and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. 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.

D. ASME Compliance: Where indicated, fabricate and label commercial steam boiler storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric steam boilers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:

a. Light Commercial Electric Steam boilers:

1) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 LIGHT COMMERCIAL ELECTRIC STEAM BOILERS

A. Description: Comply with UL 174 for household, storage electric steam boilers.

1. Manufacturers:

a. Chromalox
b. Sussman

2. Construction: Steel, vertical arrangement.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 100 psig Interior Finish:

3. Features:

a. Water Feed System: Strainer, solenoid valve, stop valve and check valve factory wired and plumbed for direct connection to water line.
b. Low Water Cut-Off/Level Control: McDonnell Miller No. 150 control automatically maintains proper water level, shutting off the boiler when water supply in the boiler drops below a safe operating level.
c. Water Level Sight Glass: Allows constant observation of water level while boiler is in operation.
d. Main On/Off switch: Allows manual operation of the boiler operating control circuit.
e. Pilot Light: Indicated control circuit' son/off condition.
f. Integral Power Contactors: Magnetic contractors for energizing the boiler elements. Integrally mounted in the control unit.
g. Blowdown/Drain Valves: Facilitates emptying the boiler pressure vessel and MM150 water column piping during blowdown sequence.
h. Long Life Heating Elements: Industrial grade, heavy duty 0.420-inch diameter stainless steel heating elements, equipped with one piece resistance welded terminations for added strength and safety.
i. Operating Pressure Control: Resets automatically to maintain preset pressure within boiler.

j. Energy Savings and Minimum Maintenance: Pressure vessel insulation minimizes heat loss and maximizes energy savings, insured by fibrous glass material.
k. Easy Control Maintenance: All control panels and components are easily accessible. Fully-louvered openings avoid component heat build-up.
l. NEMA 1 louvered enclosure standard.
m. Trim Pressure: Factory standard 100 PSIG
n. UL Listed.

4. Capacity and Characteristics:

a. Lbs./hr. Steam: 72.3.
b. Electrical Characteristics:

1) Power Demand: 24 KW
2) Volts: 480.
3) Phases: Three.
4) Hertz: 60.

c. Model ES-24 manufactured by Sussman Electric Boilers.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect steam boiler storage tanks, specified to be ASME code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial steam boiler storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 - EXECUTION

3.1 STEAM BOILER INSTALLATION

A. Install commercial steam boiler on existing concrete base.

B. Install steam boiler 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.

C. Install steam boiler 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 steam boilers that do not have tank drains. Refer to Division 22 Section 22 1119 "Domestic Water Piping Specialties" for hose end drain valves.

D. Install thermometer on outlet piping of steam boilers. Refer to Division 22 Section 22 0519 "Meters and Gauges for Plumbing Piping" for thermometers.

E. Install pressure gauge(s) on inlet and outlet of commercial electric steam boiler piping. Refer to Division 22 Section 22 0519 "Meters and Gauges for Plumbing Piping" for pressure gauges.

F. Fill steam boilers with water.

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 steam boilers to allow service and maintenance. Arrange piping for easy removal of steam boilers.

C. Ground equipment according to Division 26 Section 26 0526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section 26 0519 "Low Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect, test, and adjust 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. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace steam boilers that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and instantaneous electric steam boilers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3300

SECTION 22 4500 - EMERGENCY PLUMBING FIXTURES

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 the following emergency plumbing fixtures:

1. Water tempering equipment.

B. Related Sections include the following:

1. Division 22 Section 22 1119 "Domestic Water Piping Specialties" for backflow preventers.
2. Division 22 Section 22 1319 "Sanitary Waste Piping Specialties" for floor drains.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Tepid: Moderately warm.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 WATER TEMPERING EQUIPMENT

A. Water Tempering Equipment

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Bradley Corporation
    b. Encon Safety Products
    c. Haws Corporation
    d. Powers, a Watts Industries Company
    e. Speakman Company

2. Description: Factory fabricated, hot and cold water tempering equipment with thermostatic mixing valve.

    a. Thermostatic Mixing Valve: Designed to provide 85°F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5°F throughout required 15-minute test period, and in case of unit failure to continue cold water flow, with union connections, controls, metal piping, and corrosion resistant enclosure.
    b. (SSEW-1): Model G3800LF manufactured by Guardian.
    c. (EW-1): Model G3600 LF manufactured by Guardian.

2.2 SOURCE QUALITY CONTROL

A. Certify performance of plumbed plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Install shutoff valves in water supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section 22 0523 "General-Duty Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

B. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

C. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section 22 0519 "Meters and Gages for Plumbing Piping."

D. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section 22 1316 "Sanitary Waste and Vent Piping."

E. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section 22 0500 "Common Work Results for Plumbing."

F. Fill self-contained fixtures with flushing fluid.

G. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect hot and cold water supply piping to hot and cold water tempering equipment. Connect output from water tempering equipment to emergency plumbing fixtures.

C. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.

D. Ground equipment according to Division 26 Section 26 0526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section 26 0519 "Low Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Mechanical Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

B. Electrical Component Testing: After electrical circuitry has been energized, test for compliance with requirements.

1. Test and adjust controls and safeties.

C. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

D. Report test results in writing.

3.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 22 4500

SECTION 22 6100 - 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.
5. Pressure regulators.
6. Mechanical sleeve seals.
7. Grout.

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. Minimum Operating Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural Gas System Pressure within Buildings: 0.5 psig or less.

1.5 SUBMITTALS

A. Product data for each type of the following:

1. Piping.
2. Piping specialties.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.
6. Mechanical sleeve seals.
7. Escutcheons.

B. Welding certificates.

C. Field quality control reports.

D. Operation and Maintenance Data: For motorized gas valves and pressure regulators to include in emergency, operation, and maintenance manuals.

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.

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.

B. Interruption of Existing Natural gas Service: Do not interrupt natural gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural gas supply according to requirements indicated:

1. Notify Architect, Construction Manager, or Owner no fewer than two days in advance of proposed interruption of natural gas service.
2. Do not proceed with interruption of natural gas service without Architect's, Construction Manager's, or Owner's written permission.

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 Division 08 Section "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.

6. Mechanical Couplings:

    a. Manufacturers - subject to compliance with requirements, provide products by one of the following:

        1) Dresser Piping Specialties; Division of Dresser, Inc.
        2) Smith-Blair, Inc.

    b. Steel flanges and tube with epoxy finish.
    c. Buna-nitrile seals.
    d. Steel bolts, washers, and nuts.
    e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

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 (3.45 kPa).
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 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

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°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 (DN 50) 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 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) 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.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Division
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Company
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate pack nut with adjustable stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural gas service with "WOG" indicated on valve body.
11. -stem packing.
12. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" articles.
13. CWP Rating: 600 psig.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Lee Brass Company
    b. McDonald, A. Y. Mfg. Company

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural gas service with "WOG" indicated on valve body.

F. Cast Iron, Non-lubricated Plug Valves: MSS SP-78.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. McDonald, A. Y. Mfg. Company
    b. Mueller Co.; Gas Products Division
    c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.

6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural gas service with "WOG" indicated on valve body.

G. Cast Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. McDonald, A. Y. Mfg. Company
   d. Milliken Valve Company
   e. Mueller Co.; Gas Products Division
   f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. 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 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. Actaris
   b. American Meter Company
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management
   e. Invensys
   f. Maxitrol Company
   g. Richards Industries; Jordan Valve Division

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc plated steel; interchangeable.

4. Diaphragm Plate: Zinc plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory or field installed, stainless steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Division
    c. Harper Wyman Company
    d. Maxitrol Company
    e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc plated steel; interchangeable.
4. Diaphragm Plate: Zinc plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet stabilized, mineral-filled nylon.
7. Factory Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.6 DIELECTRIC FITTINGS

A. Dielectric Unions

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company
    b. Central Plastics Company
    c. Hart Industries International, Inc.
    d. McDonald, A. Y. Mfg. Company
    e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
    f. Wilkins; Zurn Plumbing Products Group

2. Minimum Operating Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company
    b. Central Plastics Company
    c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
    d. Wilkins; Zurn Plumbing Products Group

2. Minimum Operating Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric Flange Kits:

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Central Plastics Company
   d. Pipeline Seal and Insulator, Inc.

2. Minimum Operating Pressure Rating: 150 psig.
3. Companion flange assembly for field assembly.
4. Include flanges, full-face or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES

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.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Metraflex Company (The)
   d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
3. Pressure Plates: Carbon steel or Stainless steel.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.9 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.

1. Finish: Polished chrome plated or rough brass.

D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.

1. Finish: Polished chrome plated or rough brass.

E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome plated finish.

F. Split-Plate, Stamped-Steel Escutcheons: With exposed-rivet hinge, set screw or spring clips, and chrome plated finish.

G. One-Piece, Floor plate Escutcheons: Cast iron floor plate.

H. Split-Casting, Floor plate Escutcheons: Cast brass with concealed hinge and set screw.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.11 LABELING AND IDENTIFYING

A. 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 54 and 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 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. Install escutcheons at penetrations of interior walls, ceilings, and floors.

1. New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome plated finish.
    c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    d. Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome plated finish.
    e. Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
    f. Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    g. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw or spring clips.
    h. Piping in Equipment Rooms: One-piece, cast-brass type.
    i. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
    j. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor plate type.

2. Existing Piping:

    a. Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome plated finish.
    b. Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
    c. Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome plated finish.
    d. Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.

e. Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
f. Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
g. Piping in Equipment Rooms: Split-casting, cast-brass type.
h. Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
i. Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor plate type.

L. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

M. Verify final equipment locations for roughing-in.

N. Comply with requirements in Sections specifying gas fired appliances and equipment for roughing-in requirements.

O. 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 long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

Q. 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.

R. 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.

S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

T. Connect branch piping from top or side of horizontal piping.

U. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

V. Do not use natural gas piping as grounding electrode.

W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

X. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Division 22 Section 22 0519 "Meters and Gauges for Plumbing Piping."

3.4 VALVE INSTALLATION

A. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.5 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 dry seal 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.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch.

3.7 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.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section 22 0553 "Identification for Plumbing 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.

3.9 PAINTING

A. Comply with requirements in Division 09 painting Sections 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 gloss.
    d. Color: Yellow.

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: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex gloss.
    d. Color: Yellow.

2. Alkyd System: MPI INT 5.1E.

    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd gloss.
    d. Color: Yellow.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas 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.

3.11 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

A. Aboveground piping shall be one of the following:

1. Steel pipe with malleable iron fittings and threaded joints (2 inch and under).
2. Steel pipe with wrought steel fittings and welded joints (2-1/2 inch and over).

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:

1. Bronze plug valve.
2. Cast iron, non-lubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:

1. Bronze plug valve.
2. Cast iron, non-lubricated or lubricated plug valve.

E. Valves in branch piping for single appliance shall be the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

END OF SECTION 22 6100

SECTION 22 6113 - COMPRESSED AIR PIPING FOR LABORATORY FACILITIES

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 piping and related specialties for general service compressed air systems operating at 200 psig (1380 kPa) or less.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. High pressure Compressed air Piping: System of compressed air piping and specialties operating at pressures between 150 and 200 psig.

C. Low pressure Compressed air Piping: System of compressed air piping and specialties operating at pressures of 150 psig or less.

1.4 SUBMITTALS

A. Product data for the following:

1. Dielectric fittings.
2. Flexible pipe connectors.
3. Safety valves.
4. Pressure regulators. Include rated capacities and operating characteristics.
5. Automatic drain valves.
6. Filters. Include rated capacities and operating characteristics.
7. Lubricators. Include rated capacities and operating characteristics.
8. Hose assemblies.
9. Quick couplings.

B. Brazing and welding certificates.

C. Qualification Data: For Installers.

D. Field quality control test reports.

E. Operation and Maintenance Data: For general-service compressed air piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Pressure-Seal Joining Procedure for Steel Piping. Qualify operators according to training provided by Victaulic Company.

B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

D. ASME Compliance:

1. Comply with ASME B31.1, "Power Piping," for high pressure compressed air piping.
2. Comply with ASME B31.9, "Building Services Piping," for low pressure compressed air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.

1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

B. Copper Tube: ASTM B 88, Type K seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed air piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

F. 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.

2.3 VALVES

A. Metal Ball, Butterfly, Check, Gate, and Globe Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

2.4 DIELECTRIC FITTINGS

A. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Dielectric Unions: Factory fabricated union assembly, for 250-psig minimum working pressure at 180°F.

C. Dielectric Flanges: Factory fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

2.5 FLEXIBLE PIPE CONNECTORS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Hyspan Precision Products, Inc.
4. Mercer Rubber Company
5. Metraflex, Inc.
6. Proco Products, Inc.
7. Unaflex, Inc.
8. Universal Metal Hose; a Hyspan Company

B. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: 200 psig minimum.
2. End Connections, NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections, NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

C. Stainless Steel Hose Flexible Pipe Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: 200 psig minimum.
2. End Connections, NPS 2 (DN 50) and Smaller: Threaded steel pipe nipple.
3. End Connections, NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Stack Sleeve Fittings: Manufactured, cast iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.7 ESCUTCHEONS

A. General Requirements: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Escutcheons: Cast iron.

H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.8 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.

1. Type: Pilot operated.

C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

D. Automatic Drain Valves: Stainless steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.

E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.

F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

G. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated.

1. Provide with automatic feed device for supplying oil to lubricator.

2.9 QUICK COUPLINGS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Aeroquip Corporation; Eaton Corporation
2. Bowes Manufacturing Inc.
3. Foster Manufacturing, Inc.
4. Milton Industries, Inc.
5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Division
6. Rectus Corp.
7. Schrader-Bridgeport; Amflo Division
8. Schrader-Bridgeport/Standard Thomson.
9. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
10. TOMCO Products Inc.
11. Tuthill Corporation; Hansen Coupling Division

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug End: Flow-sensor-bleeder, check-valve type with barbed outlet for attaching hose.

D. Valveless Quick Couplings: Straight-through brass body with stainless steel or nickel-plated-steel operating parts.

1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug End: With barbed outlet for attaching hose.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Low pressure Compressed Air Distribution Piping: Use one of the following piping materials for each size range:

1. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
3. NPS 2 (DN 50) and Smaller: Type K, copper tube; wrought-copper fittings; and brazed joints.
4. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
5. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K, copper tube; wrought-copper fittings; and brazed joints.
6. NPS 5 (DN 125) and Larger: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.

B. High pressure Compressed Air Distribution Piping: Use one of the following piping materials for each size range:

1. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
3. NPS 2 (DN 50) and Smaller: Type K, copper tube; wrought-copper fittings; and brazed joints.
4. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
5. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K, copper tube; wrought-copper fittings; and brazed joints.
6. NPS 5 (DN 125) and Larger: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.

C. Drain Piping - use one of the following piping materials:

1. NPS 2 (DN 50) and Smaller: Type K copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

A. General-Duty Valves: Comply with requirements in Division 22 Section 22 0523 "General-Duty Valves for Plumbing Piping" for metal general-duty valves. Use metal valves, unless otherwise indicated.

1. Metal General-Duty Valves: Use valve types specified in "Valve Applications" article in Division 22 Section 22 0523 "General-Duty Valves for Plumbing Piping" according to the following:

a. Low pressure Compressed Air: Valve types specified for low pressure compressed air.
b. High pressure Compressed Air: Valve types specified for medium pressure compressed air.
c. Equipment Isolation NPS 2 (DN 50) and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.
d. Grooved-end valves may be used with grooved-end piping and grooved joints.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, 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 otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

H. Equipment and Specialty Flanged Connections:

1. Use steel companion flange with gasket for connection to steel pipe.
2. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

I. Flanged joints may be used instead of specified joint for any piping or tubing system.

J. Install eccentric reducers where compressed air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

K. Install branch connections to compressed air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

L. Install thermometer and pressure gauge on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section 22 0519 "Meters and Gauges for Plumbing Piping."

M. Install piping to permit valve servicing.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

3.4 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. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints for Steel Piping: Join according to AWS D10.12/D10.12M.

E. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."

G. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

H. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section 22 0523 "General-Duty Valves for Plumbing Piping."

B. Install shutoff valves and unions or flanged joints at compressed air piping to air compressors.

C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

D. Install check valves to maintain correct direction of compressed air flow to and from compressed air piping specialties and equipment.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. NPS 2 (DN 50) and Smaller: Use dielectric unions.

C. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

D. NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install flexible pipe connectors in discharge piping of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed air tubing.

C. Install stainless steel-hose flexible pipe connectors in steel compressed air piping.

3.8 SPECIALTY INSTALLATION

A. Install air-line pressure regulators in branch piping to equipment and tools.

B. Install air-line lubricators in branch piping to machine tools.

C. Install quick couplings at piping terminals for hose connections.

3.9 CONNECTIONS

A. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

B. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

3.10 SLEEVE INSTALLATION

A. Sleeves are not required for core-drilled holes.

B. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe.

C. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.

1. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
2. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

D. Install sleeves in new walls and slabs as new walls and slabs are constructed.

E. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

1. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
2. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

    a. Seal space outside of sleeve fittings with grout.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.11 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

B. New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split-casting, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, stamped steel with set screw or spring clips.
5. Bare Piping in Equipment Rooms: One piece, stamped steel with set screw or spring clips.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.12 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Vertical Piping: MSS Type 8 or 42 clamps.

C. Individual, Straight, Horizontal Piping Runs:

1. 100 feet or Less: MSS Type 1, adjustable, steel clevis hangers.
2. Longer than 100 feet: MSS Type 43, adjustable roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

E. Base of Vertical Piping: MSS Type 52, spring hangers.

F. Support horizontal piping within 12 inches of each fitting and coupling.

G. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

H. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 to NPS 1/2 (DN 8 to DN 15): 96 inches with 3/8-inch rod.
2. NPS 3/4 to NPS 1-1/4 (DN 20 to DN 32): 84 inches with 3/8-inch rod.
3. NPS 1-1/2 (DN 40): 12 feet with 3/8-inch rod.
4. NPS 2 (DN 50): 13 feet with 3/8-inch rod.
5. NPS 2-1/2 (DN 65): 14 feet with 1/2-inch rod.
6. NPS 3 (DN 80): 15 feet with 1/2-inch rod.
7. NPS 3-1/2 (DN 90): 16 feet with 1/2-inch rod.
8. NPS 4 (DN 100): 17 feet with 5/8-inch rod.
9. NPS 5 (DN 125): 19 feet with 5/8-inch rod.
10. NPS 6 (DN 150): 21 feet with 3/4-inch rod.
11. NPS 8 (DN 200): 24 feet with 3/4-inch rod.
12. NPS 10 (DN 250): 26 feet with 7/8-inch rod.
13. NPS 12 (DN 300): 30 feet with 7/8-inch rod.

I. Install supports for vertical, Schedule 40, steel piping every 15 feet.

J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 (DN 8): 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches with 3/8-inch rod.
3. NPS 3/4 (DN 20): 84 inches with 3/8-inch rod.
4. NPS 1 (DN 25): 96 inches with 3/8-inch rod.
5. NPS 1-1/4 (DN 32): 108 inches with 3/8-inch rod.
6. NPS 1-1/2 (DN 40): 10 feet with 3/8-inch rod.
7. NPS 2 (DN 50): 11 feet with 3/8-inch rod.
8. NPS 2-1/2 (DN 65): 13 feet with 1/2-inch rod.
9. NPS 3 (DN 80): 14 feet with 1/2-inch rod.
10. NPS 3-1/2 (DN 90): 15 feet with 1/2-inch rod.
11. NPS 4 (DN 100): 16 feet with 1/2-inch rod.
12. NPS 5 (DN 125): 18 feet with 1/2-inch rod.
13. NPS 6 (DN 150): 20 feet with 5/8-inch rod.
14. NPS 8 (DN 200): 23 feet with 3/4-inch rod.

K. Install supports for vertical copper tubing every 10 feet.

3.13 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed air piping, valves, and specialties. Comply with requirements in Division 22 Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.14 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests for Metal Compressed air Piping: Test new piping. Cap and fill general-service compressed air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters, lubricators, and pressure regulators for proper operation.

C. Prepare test reports.

END OF SECTION 22 6113

SECTION 22 6213 - VACUUM PIPING FOR LABORATORY FACILITIES

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 the following:

1. Laboratory low-vacuum piping and specialties, designated "laboratory low vacuum" operating at 12 inches mercury (40.6 kPa vacuum).
2. Laboratory high-vacuum piping and specialties, designated "laboratory high vacuum" operating at 24 inches mercury (81.3 kPa vacuum).

B. Related Sections include the following:

1. Division 11 Section "Laboratory Fume Hoods" for vacuum outlets in laboratory fume hoods.
2. Division 12 Section "Laboratory Casework" for vacuum outlets in casework.

C. Related Sections include the following:

1. Division 11 Section "Laboratory Fume Hoods" for vacuum outlets in laboratory fume hoods.
2. Division 12 Section "Laboratory Casework" for vacuum outlets in casework.

1.3 DEFINITIONS

A. D.I.S.S.: Diameter-index safety system.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 SUBMITTALS

A. Product data for the following:

1. Vacuum pipes and fittings.
2. Vacuum valves.

B. Shop Drawings.

C. Piping Material Certification: Signed by Installer certifying that medical vacuum piping materials comply with NFPA 99 requirements.

D. Qualification Data: For Installer and testing agency.

E. Brazing certificates.

F. Field quality control test reports.

G. Operation and Maintenance Data: For vacuum piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.

B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

C. 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.

D. Comply with ASME B31.9, "Building Services Piping," for vacuum piping in laboratory facilities.

E. NFPA Compliance: Comply with NFPA 99, "Health Care Facilities," for medical vacuum system materials and installation in healthcare facilities.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Laboratory Vacuum Service(s): Do not interrupt laboratory vacuum service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect or Owner no fewer than two days in advance of proposed interruption of laboratory vacuum service(s).
2. Do not proceed with interruption of laboratory vacuum service(s) without Architect's or Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Copper Medical Gas Tube: ASTM B 819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue.

1. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.
2. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
3. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.

2.2 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.3 VALVES

A. Copper-Alloy Ball Valves: MSS SP-110, 3-piece body, brass or bronze.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Allied Healthcare Products, Inc.; Chemetron Division
    b. Amico Corporation.
    c. BeaconMedaes.
    d. Conbraco Industries, Inc.

2. Pressure Rating: 300 psig (2070 kPa) minimum.
3. Ball: Full-port, chrome-plated brass.
4. Seats: PTFE or TFE.
5. Handle: Lever.
6. Stem: Blowout proof with PTFE or TFE seal.
7. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

B. Bronze Check Valves: In-line pattern.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. Allied Healthcare Products, Inc.; Chemetron Division
    b. Amico Corporation.
    c. BeaconMedaes.
    d. Conbraco Industries, Inc.

2. Pressure Rating: 300 psig (2070 kPa) minimum.
3. Operation: Spring loaded.
4. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

2.4 FLEXIBLE PIPE CONNECTORS

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. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Hyspan Precision Products, Inc.
4. Mercer Rubber Co.
5. Metraflex, Inc.
6. Proco Products, Inc.
7. Unaflex.
8. Universal Metal Hose; a Hyspan Company

C. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: 250 psig minimum.
2. End Connections: Threaded copper pipe or plain-end copper tube.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Escutcheons: Cast iron.

H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing are not available or if pre-cleaned fittings or tubing must be re-cleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb. of chemical to 3 gallons of water.

    a. Scrub to ensure complete cleaning.
    b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING APPLICATIONS

A. Connect new copper tubing to existing tubing with memory-metal couplings.

B. Non-healthcare Laboratory Low Vacuum Piping: Use the following piping materials for each size range:

1. NPS 4 (DN 100) and Smaller: Type L, copper medical gas tube; wrought-copper fittings; and brazed or soldered joints.

C. Non-healthcare Laboratory High Vacuum Piping: Use the following piping materials for each size range:

1. NPS 4 (DN 100) and Smaller: Type L, copper medical gas tube; wrought-copper fittings; and brazed or soldered joints.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of vacuum piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Comply with ASSE Standard #6010 for installation of vacuum piping.

C. Install piping concealed from view and protected from physical contact by building occupants 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 and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install vacuum and drain piping with 1 percent slope downward in direction of flow.

H. Install nipples, unions, and special fittings, and valves with pressure ratings same as or higher than piping pressure rating used in applications below unless otherwise indicated.

I. Install eccentric reducers, if available, where vacuum piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install piping to permit valve servicing.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and for branch connections. Extruded-tee branch outlets in copper tubing may be made where specified.

N. Connect vacuum piping to vacuum producers and to equipment requiring vacuum service.

O. Install unions, in copper vacuum tubing adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.

3.4 VALVE APPLICATIONS

A. Valves for Copper Vacuum Tubing: Use copper alloy ball and bronze check types.

3.5 VALVE INSTALLATION

A. Install shutoff valve at each connection to and from vacuum equipment and specialties.

B. Install check valves to maintain correct direction of vacuum flow to vacuum-producing equipment.

C. Install flexible pipe connectors in suction inlet piping to each vacuum producer.

3.6 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Apply appropriate tape to external pipe threads.

E. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Continuously purge joint with oil-free dry nitrogen during brazing.

F. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.

3.7 INSTALLATION

A. Sleeves are not required for core-drilled holes.

B. Permanent sleeves are not required for holes formed by removable PE sleeves.

C. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe.

1. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.

D. Install sleeves in new walls and slabs as new walls and slabs are constructed.

E. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

1. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
2. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.8 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish
c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
e. Bare Piping in Equipment Rooms: One piece, cast brass
f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

2. Existing Piping:

a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
b. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split casting, cast brass.
g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Vertical Piping: MSS Type 8 or 42, clamps.

C. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer than 100 Feet: MSS Type 43, adjustable, roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

E. Base of Vertical Piping: MSS Type 52, spring hangers.

F. Support horizontal piping within 12 inches of each fitting and coupling.

G. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 (DN 8): 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches with 3/8-inch rod.
3. NPS 3/4 (DN 20): 84 inches with 3/8-inch rod.
4. NPS 1 (DN 25): 96 inches with 3/8-inch rod.
5. NPS 1-1/4 (DN 32): 108 inches with 3/8-inch rod.
6. NPS 1-1/2 (DN 40): 10 feet with 3/8-inch rod.
7. NPS 2 (DN 50): 11 feet with 3/8-inch rod.
8. NPS 2-1/2 (DN 65): 13 feet with 1/2-inch rod.
9. NPS 3 (DN 80): 14 feet with 1/2-inch rod.
10. NPS 3-1/2 (DN 90): 15 feet with 1/2-inch rod.
11. NPS 4 (DN 100): 16 feet with 1/2-inch rod.
12. NPS 5 (DN 125): 18 feet with 1/2-inch rod.
13. NPS 6 (DN 150): 20 feet with 5/8-inch rod.
14. NPS 8 (DN 200): 23 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

3.10 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Division 22 Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.11 FIELD QUALITY CONTROL FOR LABORATORY FACILITY NONMEDICAL VACUUM PIPING

A. Testing Agency: Engage qualified testing agency to perform field tests and inspections of vacuum piping in nonmedical laboratory facilities.

B. Perform tests and inspections of vacuum piping in nonmedical laboratory facilities.

C. Tests and Inspections:

1. Piping Leak Tests for Vacuum Piping: Test new and modified parts of existing piping. Cap and fill vacuum piping with oil-free, dry nitrogen. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

    a. Test Pressure for Copper Tubing: 150 psig.

2. Repair leaks and retest until no leaks exist.
3. Inspect filters for proper operation.

D. Prepare test reports.

3.12 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain medical vacuum alarm systems. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 6213

SECTION 22 6600 - CHEMICAL WASTE SYSTEMS FOR LABORATORY FACILITIES

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. Single-wall piping.
2. Piping specialties.
3. Neutralization tanks.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. FPM: Vinylidene fluoride-hexafluoro propylene copolymer rubber.

1.4 PERFORMANCE REQUIREMENTS

A. Single-Wall Piping Pressure Rating: 10 feet head of water (30 kPa).

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For neutralization tank and piping.

C. Operation and Maintenance Data: For chemical-waste specialties and neutralization tanks, to include in emergency, operation, and maintenance manuals.

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. NFPA Compliance: Comply with NFPA 70, "National Electrical Code."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties with sealing plugs in ends or with end protection.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, fittings, and seals from dirt and damage.

1.8 COORDINATION

A. 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.

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. Neutralization-Tank Limestone: Equal to 200 percent of amount required for each tank sump initial charge.

PART 2 - PRODUCTS

2.1 SINGLE-WALL PIPE AND FITTINGS

A. PP Drainage Pipe and Fittings **(To be used in non-Plenum spaces only):** ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101; with fusion- and mechanical-joint ends.

1. Exception: Pipe and fittings made from PP resin without fire-retardant additive may be used for underground installation.
2. Manufacturers - subject to compliance with requirements, provide products by one of the following:

a. IPEX Inc.
b. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
c. Sloane, George Fischer Inc.
d. Watts Industries (Canada) Inc.
e. Zurn Plumbing Products Group; Chemical Drainage Systems.

B. PVDF Drainage Pipe and Fittings **(To be used in all Plenum Spaces):** ASTM F 1673, Schedule 40, pipe and drainage-pattern fittings. Include fittings with fusion- and mechanical-joint ends.

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

a. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
b. Sloane, George Fischer Inc.
c. Watts Industries (Canada) Inc.
d. Zurn Plumbing Products Group; Chemical Drainage Systems.

2.2 JOINING MATERIALS

A. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

B. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

C. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

D. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 PIPING SPECIALTIES

A. Plastic Dilution Traps

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. IPEX Inc.
    b. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
    c. Sloane, George Fischer Inc.

2. Material: Corrosion-resistant PP, with removable base.
3. End Connections: Mechanical joint.

B. PP Sink Outlets:

1. Description: NPS 1-1/2 (DN 40), with clamping device, stopper, and 7-inch high overflow fitting.

C. Plenum Rated PVDF Floor Drains (FD-1):

1. Manufacturers - subject to compliance with requirements, provide products by one of the following:

    a. IPEX Inc.
    b. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
    c. Sloane, George Fischer Inc.

2. Material: PVDF
3. Model: Plenum plus PVDF by Orion.

2.4 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, plain ends.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.5 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, Inc.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating f length required to secure pressure plates to sealing elements.

2.6 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.

D. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw or spring clips, and chrome-plated finish.

E. One-Piece, Floor-Plate Escutcheons: Cast iron.

F. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Chemical-Waste Piping Inside the Building:

1. Install piping next to equipment, accessories, and specialties to allow service and maintenance.
2. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.
3. Flanges may be used on aboveground piping unless otherwise indicated.
4. Install underground fiberglass piping according to ASTM D 3839.
5. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
6. 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.
7. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
8. Install piping at indicated slopes.
9. Install piping free of sags and bends.
10. Install fittings for changes in direction and branch connections.
11. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

    a. New Piping:

        1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
        2) Insulated Piping: One-piece, stamped-steel type with spring clips.
        3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
        4) Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
        5) Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw or spring clips.
        6) Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
        7) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
13. Verify final equipment locations for roughing-in.

3.3 PIPING SPECIALTY INSTALLATION

A. Embed floor drains in 4-inch minimum depth of concrete around bottom and sides. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for concrete.

B. Fasten grates to drains if indicated.

3.4 JOINT CONSTRUCTION

A. Chemical Waste Piping Inside the Building:

1. Plastic-Piping Electrofusion Joints for PP piping: Make polyolefin drainage-piping joints according to ASTM F 1290.
2. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.
3. Mechanical Joints for PVDF piping: Use mechanical joints compatible with PVDF piping.

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe sizes in this article refer to aboveground, single-wall piping.

B. Comply with requirements in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

C. Install the following:

1. Vertical Piping: MSS Type 8 or MSS Type 42, riser clamps.
2. 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.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

D. Comply with requirements in Division 22 Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment" for installation of supports.

E. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

F. Support vertical piping and tubing at base and at each floor.

G. Rod diameter may be reduced 1 size for double-rod hangers, to minimum of 3/8 inch.

H. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50): 33 inches with 3/8-inch rod.
2. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches with 1/2-inch rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches with 5/8-inch rod.
4. NPS 6 (DN 150): 48 inches with 3/4-inch rod.
5. NPS 8 (DN 200): 48 inches with 7/8-inch rod.

I. Install supports for vertical PP piping every 72 inches.

J. Install vinyl-coated hangers for PVDF piping with the following maximum horizontal spacing and minimum rod diameters:

1. All Sizes: Install continuous support for piping with liquid waste at temperatures above 140°F.
2. NPS 1/2 (DN 15) and smaller: 30 inches with 3/8-inch rod.
3. NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40): 36 inches with 3/8-inch rod.
4. NPS 2 (DN 50): 36 inches with 3/8-inch rod.
5. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches with 1/2-inch rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches with 5/8-inch rod.
7. NPS 6 (DN 150): 48 inches with 3/4-inch rod.

K. Install supports for vertical PVDF piping NPS 1-1/2 (DN 40) every 48 inches and NPS 2 (DN 50) and larger every 72 inches.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Use commercially manufactured wye fittings for sewerage piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

C. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.

D. Install piping adjacent to equipment to allow service and maintenance.

3.7 LABELING AND IDENTIFICATION

A. Comply with requirements in Division 22 Section 22 0553 "Identification for Plumbing Piping and Equipment" for labeling of equipment and piping.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of sewerage piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place and again at completion of Project.

1. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between inspection points.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Hydrostatic Tests for Drainage Piping:

        1) Allowable leakage is a maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
        2) Close openings in system and fill with water.
        3) Purge air and refill with water.
        4) Disconnect water supply.
        5) Test and inspect joints for leaks.

    e. Air Tests for Drainage Piping: Comply with UNI-B-6.

2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Submit separate reports for each test.

B. Replace leaking sewerage piping using new materials, and repeat testing until leakage is within allowances specified.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. Perform 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.

E. Chemical-waste piping will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.9 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Clean piping by flushing with potable water.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain neutralization tank.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below unless otherwise indicated.

B. Aboveground Chemical-Waste and Vent Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and electrofusion joints. **(non-plenum Spaces) (Contractor to field verify if they want to use this piping above grade!)**
2. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVDF drainage piping and electrofusion joints **(Plenum Spaces).**

C. Under Slab-on-Grade, Indoor, Chemical-Waste Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and electrofusion joints.

END OF SECTION 22 6600

SECTION 23 0500 - COMMON WORK RESULTS FOR HVAC

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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Definitions
2. Permits, Codes, and Inspections.
3. Visiting Premises
4. Sleeves.
5. Escutcheons.
6. HVAC demolition.
7. Painting and finishing.
8. Fire stopping.
9. Supports and anchorages.
10. Access doors and panels.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. Product data for the following:

1. Escutcheons.
2. Access doors and panels.

1.5 PERMITS, CODES, AND INSPECTIONS

A. Contractor shall obtain and pay for all permits and inspections required by laws, ordinances, rules, and regulations having jurisdiction for work included under this Contract, and shall submit approval certificates to the Architect.

B. The HVAC installation shall comply fully with:

1. All local, county and state laws, ordinances and regulations having jurisdiction and as applicable to the HVAC installations.
2. All approved published instructions set forth by manufacturers of equipment furnished or installed on this project.

C. The HVAC installation and all components shall be in compliance with all applicable codes and ordinances adopted by the local authority having jurisdiction. Unless noted otherwise in the applicable codes and ordinances adopted by the local authority having jurisdiction, requirements of the latest or state-adopted edition of the following Standards shall apply.

1. American Society for Testing and Materials (ASTM)
2. Americans with Disabilities Act (ADA)
3. International Building Code (IBC)
4. International Fire Code (IFC)
5. International Energy Conservation Code (IECC)
6. National Electric Code (NEC)
7. National Fire Protection Association (NFPA)
8. National Safety Code
9. Occupational Safety and Health Act (OSHA)
10. Sheet Metal & Air Conditioning Contractors National Association Standards (SMACNA)
11. Underwriter's Laboratories, Inc. (UL)

D. Submit certificates issued to authorized agencies which indicate the work conforms to the above requirements, as well as any additional certificates as may be required for the performance of this contract work.

E. Certificate of Inspection: The Contractor shall procure and pay for the Certificate of Inspection from the municipality-approved inspection agency and deliver it to the Architect before final payment is made.

1.6 VISITING PREMISES

A. All bidders shall visit the project site prior to submitting a bid proposal. It is the Contractor's responsibility to examine existing conditions. Sufficient allowances shall be included in the bid proposal to perform work that may not be illustrated on the drawings, but due to existing conditions can be reasonably inferred as belonging to work required to complete this contract. Items which cannot be determined from a visual inspection, such as unforeseen conditions that are buried within walls, beneath concrete floors, or above hard ceilings, would not apply.

B. By submission of a bid, the Contractor is attesting that responsible personnel did in fact visit the site during the bidding period and verified all existing pertinent conditions.

C. Contractor shall verify all measurements and dimensions at the site which may materially affect the contract price prior to submitting a bid proposal.

1.7 QUALITY ASSURANCE

A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts with shop-applied plastic covers over each opening of every duct. Prior to applying the plastic covers on each duct, vacuum all dirt and debris from its interior. Maintain the plastic covers through shipping and storage. Handle ducts to prevent damage to the ducts and to the plastic covers. If a ducts plastic cover(s) is damaged or comes loose, re-vacuum the interior of the duct and apply new plastic covers. The plastic cover shall be maintained over the openings of each duct until that duct is ready to be installed.

1.9 DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.

B. Any apparatus, appliance, material or work not typically shown on drawings as standard industry practice but is mentioned in the specifications, or vice versa, shall be provided by the HVAC Trade without additional expense to the Owner.

C. The drawings are diagrammatic, intending to show general arrangement and location of system components, and are not intended to be rigid in detail.

D. Due to the small scale of the drawings, all offsets and fittings required for a complete installation may not be shown but shall be provided at no change in Contract price.

E. The equipment schedules shown on the drawings list the manufacturer used as the basis of design in the preparation of the Bid Drawings.

1. The equipment specifications list that manufacturer as well as other manufacturers the Engineer, Architect and/or Owner find acceptable from a performance and product quality perspective, but not as the basis of design, provided the requirements of the specifications are met.
2. Listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether they offer products which meet all of the specified requirements.

    a. Manufacturers shall only offer proposals that meet the specified items.
    b. Substitutions that in the engineer's opinion, do not meet the specified requirements due to variations in manufacturing or available options, will not be approved.

3. Listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether they have a positive or negative monetary impact on the design shown on the Bid Drawings.
4. In addition, listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether the dimensions of these products will have a negative impact on the space allotted for this equipment.
5. If the Contractor or his Subcontractors decide to use a product or manufacturer that is listed as acceptable in the specifications but is different from the product or manufacturer scheduled on the drawings, it will be the responsibility of the Contractor or his Subcontractors to fully explore the product to ensure that it can be installed in the space allotted and shall pay any and all costs (including additional professional design fees) associated with the use of these products or manufacturers that impact the structure, the electrical system(s), the plumbing system(s) and/or the fire protection system(s) due to an increase in weight, electrical load, drain and vent requirements, connection sizes, etc., between the scheduled item and the equipment item used.

6. Use of a product or manufacturer not scheduled on the Bid Drawings constitutes a representation that:

    a. The HVAC Trade has investigated the proposed product and determined that the product can be installed within the space allotted.

b. The HVAC Trade will coordinate the installation of product used into the work
c. The HVAC Trade will be responsible for making all changes as may be required to make the work complete in all respects; waives all claims for additional costs under his responsibility, which may subsequently become apparent.

PART 2 - PRODUCTS

2.1 NAMEPLATE DATA

A. Provide factory-installed, permanent operational data nameplate on each item of HVAC equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.

2.2 SLEEVES

A. Galvanized Steel Sheet (For Ductwork Only): 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.3 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome plated finish.

C. One-Piece, Cast brass Type: With set screw.

1. Finish: Polished chrome plated and rough brass.

D. Split-Casting, Cast brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome plated and rough brass.

E. One-Piece, Stamped-Steel Type: With spring clips and chrome plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome plated finish.

G. One-Piece, Floor plate Type: Cast iron floor plate.

H. Split-Casting, Floor plate Type: Cast brass with concealed hinge and set screw, and chrome plated finish.

2.4 METAL SUPPORTS AND ANCHORAGES

A. Structural design shall be provided through the HVAC trade by a civil or structural Engineer who is registered in the Commonwealth of Pennsylvania.

B. Details of all structural steel shall be provided in shop drawing format. All structural steel shop drawings shall be stamped by the HVAC Trade's design Engineer prior to submittal.

C. The design, materials, fabrication and erection shall conform to "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, "Code of Standard Practice for Steel Buildings and Bridges", of the American Institute of Steel Construction, and also, when applicable, shall conform to the "Code for Welding Building Construction" of the American Welding Society.

D. Steel angles, channels, and plate shall be in accord with ASTM A36.

E. Bolts, including nuts and washers, used for fabricating steel members shall be in accord with ASTM A325.

F. Steel members, including fasteners, exposed to weather shall be galvanized.

2.5 FIRESTOPPING

A. Firestopping material shall be in accordance with ASTM E 814 or UL 1479. Refer to Division 07 for requirements.

B. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Nelson Firestop Products
2. 3M Fire Protection Products
3. Tremco, Inc.; Tremco Fire Protection Systems Group
4. USG Corporation

D. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire walls, fire barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

E. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies. Refer to the Architectural Drawings for locations and types of rated horizontal assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

F. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

2.6 ACCESS DOORS AND PANELS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Bar-Co.,Inc.
2. J.L. Industries
3. Karp Associates, Inc.
4. Milcor Division, Inryco, Inc.
5. Nystrom, Inc.

B. Steel Access Doors and Frames: Factory fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded, with welds ground smooth and flush with adjacent surfaces.

1. Door material - 16-gauge steel, having a factory-prime finish suitable for field painting except as follows:

a. For kitchens, toilet rooms, janitor's closet, or elsewhere as indicated, 16-gauge stainless steel having a No. 4 finish.

2. Frame material - same material and finish as door, with the following features:

a. For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
b. For gypsum wallboard or plaster: Perforated flanges with wallboard bead.
c. For full-bed plaster applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: Furnish with concealed spring hinges or concealed continuous piano hinge.

D. Fire rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

1. Fire Resistance Rating: Not less than 1½-hours.

E. Locking Devices: Flush, screwdriver operated cam locks.

F. Size: Doors and/or panels shall be of sufficient size for the intended function, but not less than 12 inches by 16 inches.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Before any HVAC construction work is performed and/or any equipment and materials are ordered, the HVAC Trade shall examine the project area(s) where HVAC work will be performed to verify actual locations, dimensions, and other conditions that may affect the installation of HVAC equipment, materials and associated work.

3.2 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

D. Cooperation and Coordination with Other Trades:

1. This HVAC trade must cooperate completely and coordinate work with the General Trade and other trades providing equipment under this division and other divisions of the specifications.

3.3 SUBSTITUTIONS

A. Provide in accordance with Division 01 Section SUBSTITUTION PROCEDURES and as stated below.

B. Where the contractor proposes substitute equipment, contractor to submit complete product data indicating compliance with all requirements of the documents, including performance rating, size and resistance to wear and deterioration equivalent to the specified item at least ten (10) days prior to the bid date. In instances where substituted equipment requires additional material or work beyond that shown or required by the specified item, said additional material or work shall be the responsibility of this Contractor, regardless of the trade involved.

3.4 SUBMITTALS

A. Provide in accordance with Division 01 Section SUBMITTAL PROCEDURES.

3.5 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Remove and dispose the contents of any piping indicated to be removed, including but not limited to glycol, refrigerant, or fuel oil in a lawful manner compliant with all applicable codes, ordinances, and authorities having jurisdiction.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

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. The HVAC trade shall demolish all work as outlined on the drawings.

E. The Owner shall decide the disposition of all removed materials. The HVAC trade shall deliver to the Owner all materials identified to be salvaged. The HVAC trade shall properly dispose of all materials not identified to be salvaged.

F. Refer to the paragraph entitled "Special Conditions Related to HVAC Work" in this section for requirements related to utility shut downs, capping of existing system, and air balancing services which may be required.

G. When demolishing existing equipment, the HVAC trade shall remove all existing piping, ductwork, insulation, supports, hangers, hanger rods, anchor bolts, structural steel, and concrete pads related to the work being removed. When demolishing piping or ductwork branch run outs, remove the entire branch which is accessible above lay-in ceilings or accessible during the construction period back to the main, unless otherwise noted. When demolishing equipment and diffusers and the branch run outs are inaccessible, cap, seal, and abandon the branch run outs in an approved manner.

H. Where demolition of work results in unsightly openings in occupied spaces or jeopardizes the integrity of a fire or smoke barrier, the opening shall be patched in accordance with the paragraph in this section entitled "Cutting and Patching".

I. Where demolition requires the removal of a concrete equipment pad, remove the pad, cut all anchor bolts, dowel pins, and steel bases off flush with the floor so as to eliminate any tripping hazard. Fill any openings, voids, or holes with a fine cement grout or another appropriate floor patching material. Provide surface finish to match adjacent flooring material.

3.6 CUTTING AND PATCHING

A. Cutting and patching shall be in accordance with the General Conditions and the applicable Section of Division 01, General Requirements.

B. The HVAC trade shall seal all openings he has utilized in fire rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire-rating equal to or greater than the rating of the floor, ceiling or partition material.

C. The HVAC trade shall be responsible for providing all cutting, patching, and finishing of existing construction which is not specifically shown on the Architectural Drawings and which is required for the proper installation of his equipment and materials which are to be installed in the existing portion of this project. This work shall also be provided when removing existing equipment and materials. All cutting shall be kept to an absolute minimum consistent with the requirements of the project.

D. Cutting, patching and finishing shall be performed by workmen skilled in this type of work. All patching shall be done utilizing materials of the same quality and texture as the adjacent undisturbed areas. All finishing shall match the undisturbed adjacent areas. Painting of the final finished areas, where general construction work occurs, will be the responsibility of the General Trade. Painting of the final finished areas, where no general construction work occurs, shall be the responsibility of the HVAC trade. The HVAC trade shall paint entire plane in which damage occurs whether the surface is a wall or a ceiling.

E. No cutting shall be done which may affect the building structurally or architecturally without first consulting with the General Trade and then securing the approval of the Architect. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons or other construction. Where such unsightly conditions are caused, the HVAC trade shall be required, at his own expense, to repair the damaged areas. Note: all holes or openings in existing concrete or masonry shall be drilled, core bored or saw cut.

F. Where an openings is cut into a block or brick wall for the purpose of ductwork or piping to pass through the wall, the HVAC trade shall be responsible for furnishing and installing a properly sized lintel to support the block or brick above the opening.

G. Where present equipment or material is removed and unused openings remain in walls, floors, partitions, etc., the HVAC trade shall properly patch all such openings.

3.7 SPECIAL CONDITIONS RELATED TO HVAC WORK

A. During the course of construction, cap or otherwise seal off, in an approved manner, those portions of the piping or duct system in which work is not being performed, in order to prevent the entry of dirt or dust. Should the HVAC trade fail to cover open ends of ducts, he may be required to vacuum the entire duct system and remove sections of ductwork for inspection.

B. The HVAC trade shall coordinate all utility shutdowns with the Owner to determine when the most advantageous time is for the Owner to accommodate the utility shutdown. The HVAC trade shall coordinate the utility shutdown a minimum of 7 days in advance.

C. When the HVAC trade demolishes only a portion of an existing air system and the remainder of the system is to remain in service, the Testing and Balancing trade shall measure the air flow in the undisturbed portions of system prior to disconnecting work in the construction areas. The Testing and Balancing trade shall rebalance the affected systems to these measurements immediately following the disconnection of the ductwork being demolished/modified and also immediately after placing the new/modified system into service.

D. Install equipment along with control devices and all replaceable fittings with sufficient clearance for operation and maintenance functions.

E. Do not install piping and ductwork in transformer vaults, elevator equipment rooms or electrical equipment rooms unless the piping and/or ductwork serves HVAC equipment located in that room and is dedicated to provide cooling and/or heating to that room. Do not install piping and ductwork adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.

F. Exposed piping shall be run so as to allow maximum headroom consistent with proper pitch. Piping shall not interfere with any light, opening, door, window or equipment. Headroom in front of openings, doors and windows shall not be less than the top of the opening. Minimum clearance of 1 inch shall be maintained around all piping, valves and fittings.

G. Lay out the work and establish all heights required for installation.

H. Provide safety guards for all pulleys, belt-drives and rotating equipment. Safety requirements of OSHA shall be met.

3.8 SPACE PRIORITY

A. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems.
2. Vent piping systems.
3. Ceiling recessed lighting fixtures.
4. Concealed air terminal units, fans.
5. Air duct systems.
6. Sprinkler systems piping.
7. Forced flow piping systems.
8. Electrical conduit, wiring, control wiring.

B. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.

C. Change in order of priority is permissible by mutual agreement of all affected trades.

D. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.

E. The work of a particular trade shall not obstruct access for installation, operation, and maintenance of the Work, materials and equipment of another trade.

3.9 ESCUTCHEONS

A. Install escutcheons where piping penetrates walls, ceilings, and floors according to the following:

1. New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Insulated Piping: One-piece, stamped-steel type with spring clips.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast brass type with polished chrome plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece (for drywall type ceilings) or split-casting (for lay-in type ceilings), cast brass type with polished chrome plated finish.
   e. Bare Piping in Unfinished Service Spaces and Equipment Rooms: One-piece, cast brass type with polished rough-brass finish.
   f. Bare Piping at Floor Penetrations in Unfinished Service Spaces and Equipment Rooms: One-piece, floor plate type.

2. Existing piping - use the following:

   a. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
   b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast brass type with chrome plated finish.
   c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
   d. Bare Piping in Unfinished Service Spaces and Equipment Rooms: Split-casting, cast brass type with rough-brass finish.
   e. Bare Piping at Floor Penetrations in Unfinished Service Spaces and Equipment Rooms: Split-casting, floor plate type.

3.10 SLEEVES

A. Sleeves are not required for core-drilled holes.

B. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than NPS 8 (DN 200).

4. seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 for material and installation requirements of joint sealants.

C. Aboveground, Exterior wall Pipe Penetrations: Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves.

D. Aboveground, Interior wall Pipe Penetrations: Seal penetrations through all walls identified to have an STC rating. Refer to the Architectural Drawings to determine the walls where this requirement applies.

1. Sealant shall be an acoustical type sealant; refer to Division 07 for requirements.

E. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for material and installation requirements of firestopping.

3.11 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 HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install all new, relocated, or owner furnished equipment in accord with the manufacturer's written installation instructions.

3.12 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 CONCRETE BASES

A. Provide all materials, equipment, supplies and labor necessary to construct all miscellaneous steel required for supporting piping, ductwork and equipment for installation of the HVAC system. All miscellaneous steel, metal supports and anchorages required for supporting ductwork, piping and equipment is not shown on the Drawings, but shall be provided.

B. All structural steel shall be designed to attach to the main building structure in such a manner as to not overstress this structure. Reinforcement of the building structure may be required in work areas located in existing buildings and in areas where the HVAC trade has relocated ductwork, piping, and equipment to areas other than is shown on the Drawings.

C. Refer to Division 05 Section "Metal Fabrications" for structural steel.

D. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

E. Shop and Field Welding: Shop and field welding shall be in accordance with AWS D1.1.

3.14 FINAL CLEANING

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES.

3.15 WARRANTIES

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES and as stated below.

B. Refer to individual equipment specifications for additional warranty requirements. If a contradiction exists, the most demanding requirements shall prevail.

C. Compile and assemble the warranties specified in Division 23 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

D. Provide complete warranty information for each item to include date of beginning of warranty or bond; duration of warranty or bond; and names, address, and telephone numbers and procedures for filing a claim and obtaining warranty services.

E. Submit a single warranty stating that all portions of the work are in accordance with Contract requirements. Warrant all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. Within 24 hours after notification, correct any deficiencies that occur during the warranty period at no additional cost to Owner, all to the satisfaction of the Owner and Architect. Obtain similar warranties from subcontractors, manufacturers, suppliers and sub-trade specialists.

F. Any material, equipment or appurtenance whose operation or performance does not comply with the requirements of the Contract Documents or that are damaged prior to acceptance will be held as defective and shall be removed and properly replaced at no additional cost to the Owner.

3.16 FIRESTOPPING

A. Firestopping is required in the following locations:

1. Where exposed and concealed horizontal ducts penetrate fire rated walls and shaft walls, except where fire dampers are installed in ducts.
2. Where exposed and concealed vertical ducts penetrate rated and non-rated floors, except where fire dampers are installed in ducts.
3. Where exposed and concealed horizontal pipes penetrate fire rated walls and shaft walls.
4. Where exposed and concealed vertical pipes penetrate rated and non-rated floors.

B. Clean surfaces to be in contact with firestopping materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

C. Install materials in accordance with printed instructions of the UL Fire Resistance Directory and per manufacturer's published instructions.

D. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.

E. Where large openings are created in walls or floors to permit installation of ducts or other items, close unused portions of opening with firestopping material tested for the application.

F. Fill annular space between duct and sleeve, with approved material. Depth of material shall be in accord with laboratory tests for 1, 2, or 3 hour rated assemblies.

G. Damming material may be temporary non-fire approved, or permanent fire-approved. Where permanent fire-approved damming material is used, depth of firestopping material may be decreased in accord with manufacturer's recommendations. Temporary damming material shall be removed after installation of firestopping material.

H. Seal all gaps or voids in cured foam with material to match the firestopping material.

I. Trim excess cured foam from around all openings and leave smooth, flush surface.

J. Position metal collar on duct penetrating floors or walls in air plenums and air shafts. Secure neck of collar to duct with screws.

3.17 INSTALLATION OF ACCESS DOORS AND PANELS

A. Access Doors and Panels:

1. Where HVAC devices which require periodic maintenance, cleaning or adjustment will be concealed in shafts, chases, above drywall ceilings and in other inaccessible general construction work, the HVAC Trade shall furnish and install access doors and panels for all such devices. These HVAC devices include, but are not limited to, valves, traps, air vents, cleanouts, damper regulators, fire dampers, smoke dampers, controls and other devices,
2. The HVAC Trade in conjunction with the General Trade shall determine door and/or panel locations subject to the Architect's approval. Locate items to be made accessible through doors and/or panels so that the doors and/or panels may be installed with not less than 6 inches between an edge and the surface of any intersecting construction or opening.
3. Access doors and panels shall be installed in accordance with the manufacturers written recommendations and Division 08 of these Specifications.

3.18 FINAL HVAC CONNECTIONS

A. Provide rough-in and final connection of all HVAC services needed for equipment provided by the Owner or by other trades. Shop Drawings will be furnished by those providing the equipment. These Drawings shall be checked by the trade responsible for rough-in and final connections before submission to the Architect for approval. The work shall be done in accordance with the approved Shop Drawings.

B. In general, connection and termination points are given in the Contract Documents. Where not given or where conflicts occur, refer the question to the Architect for a binding decision.

3.19 MAINTENANCE MANUALS

A. Provide in accordance with Division 01 Section OPERATION AND MAINTENANCE DATA and as stated below.

B. Include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Provide a cover sheet for each manual including the project name, Architect's name and contact information, Engineer's name and contact information, and Division 23 contractor's name and contact information.
6. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
7. Manufacturer's data of each piece of equipment including:

    a. Installation instructions.
    b. Drawings and Specifications.
    c. Parts list, including recommended items to be stocked.
    d. Complete wiring diagrams.
    e. Marked or changed prints locating all concealed parts and all variations from the original system design.
    f. Test and inspection certificates.

3.20 RECORD DOCUMENTS

A. Provide in accordance with Division 01 Section PROJECT RECORD DOCUMENTS and as stated below.

B. Indicate installed conditions for the following:

1. Ductwork.
2. Duct Accessories
3. Piping.
4. Piping Accessories.
5. Valves.
6. HVAC Equipment.
7. Automatic Temperature Control Panels, Control Devices, and Sensors.
8. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

3.21 DEMONSTRATION AND TRAINING

A. Provide in accordance with Division 01 Section DEMONSTRATION AND TRAINING and as stated below.

B. After the tests and adjustments have been made, approved factory-authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment installed under this Contract. Dates and times of such instructions shall be as directed by Owner, including any necessary weekend or after-hours instruction.

C. The following is a list systems that require Demonstration and Training, refer to the individual specification sections for additional training requirements:

1. Automatic Temperature Controls
2. HVAC Equipment.
3. Duct Accessories
4. Piping Accessories.

END OF SECTION 23 0500

SECTION 23 0510 - BASIC ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section includes the following:

1. Disconnect Switches
2. Fuses
3. Electrical Requirements - General
4. Piping and Ductwork Coordination

1.3 SUBMITTALS

A. Product Data:

1. For each type of disconnect switch. Include dimensions and electrical characteristics, ratings, and finishes. Also include dimensioned plans, elevations, sections, and details, Include the following:

    a. Wiring Diagrams: Power wiring.

2. For each type of fuse. Include electrical characteristics and ratings.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain disconnect switches of a single type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store disconnect switches and fuses indoors in clean, dry space with uniform temperature to prevent condensation. Protect disconnect switches and fuses from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover disconnect switches and fuses to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside equipment; install electric heating of sufficient wattage to prevent condensation.

1.6 COORDINATION

A. Coordinate layout and installation of disconnect switches 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 features of disconnect switches with pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each disconnect switch with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Acceptable Manufacturers:

1. Square D
2. Cutler Hammer
3. General Electric
4. Siemens

B. Heavy Duty Safety Switches: Provide surface-mounted, heavy-duty type, sheet-steel enclosed safety switches of types, sizes and electrical characteristics indicated on the drawings.

C. Provide switches with quick-make, quick-break type operation, with switchblades that are visible in the 'OFF' position with door open.

D. Operating handle shall be an integral part of the enclosure base the operating position shall be easily recognizable and pad-lockable in OFF position.

E. Current carrying parts shall be constructed of 98% conductivity copper, with silver-tungsten type switch contacts and positive pressure type reinforced fuse clips.

F. Enclosures shall meet environmental conditions of installed location.

1. Indoor Locations: NEMA 250, Type 1
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
5. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

G. Provide motor and motor starter disconnects with horsepower ratings suitable to the loads.

H. Fusible Switches: Heavy duty switches, with positive pressure type reinforced fuse clips and fuses of classes and current ratings indicated.

1. Non-fused disconnect switches may be used provided that the equipment nameplate makes no reference to "maximum fuse size", "maximum overcurrent protection", "fuse size" or "MFS".

I. Provide disconnect switches having the capability to have auxiliary contacts mounted as required.

J. Disconnects shall be finished in manufacturer's standard gray finish unless otherwise noted on drawings.

K. Disconnect switches specified as being an integral part of a piece of equipment shall come factory installed and wired.

2.2 FUSES

A. Acceptable Manufacturers:

1. Bussman Division of Cooper Industries, Inc.
2. Shawmut Division of Gould, Inc.
3. Littlefuse, Inc.

B. All fuses shall be Class RK1, time delay type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive disconnect switches for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ELECTRICAL REQUIREMENTS - GENERAL

A. While Electrical Trade is responsible for proper direction of rotation of all 3-phase equipment, it is the duty of the HVAC Trade to confirm that all 3-phase equipment is rotating in the proper direction during start-up of equipment and to inform the Electrical Trade of any equipment that is not rotating in the proper direction.

B. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not exceeding 18" in length.

C. All equipment shall be grounded with a green-covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end.

D. All electrical work required in Division 23 shall conform to all applicable requirements of Division 26 of these Specifications, and shall comply with the latest edition of the National Electric Code.

E. The HVAC Trade shall assign all low-voltage and line-voltage Electrical Control Work required under this Contract to the Automatic Temperature Control Subcontractor, who shall perform this work with qualified electricians employed by that Subcontractor.

F. The HVAC Trade shall co-operate with the contractor for Electrical Work in making all necessary tests and in receiving, storing and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these Contracts.

G. Single phase equipment controls and wiring shall be as follows:

1. HVAC Trade shall retain the services of an ATC Subcontractor, who shall furnish and install all control devices, such as motor sentinel switches, PE switches, thermostats, etc.
2. The Electrical Trade shall complete all power wiring and connections for single phase equipment, through the disconnect and/or the thermal cutouts and local control stations to the equipment as required.
3. The HVAC Trade will furnish a THERMAL OVERLOAD SWITCH for all single phase motors except where units are furnished with built-in Thermal Protection, in which case he will furnish a single pole switch.

H. Three phase equipment controls and wiring shall be as follows:

1. The HVAC Trade shall retain the services of an ATC Subcontractor, who shall furnish and install all control devices, such as EP and PE switches, thermostats, etc.
2. The ATC Subcontractor shall furnish and install all controls and control wiring from control devices to motor starters and contactors and between control devices.
3. The Electrical Trade shall complete all electrical connections through the disconnect, starter and motor terminals of all three phase equipment. He shall be responsible for all power wiring and connections.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers according to Division 26.

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic control devices where applicable.

1. Connect selector switches to bypass only manual control and automatic control devices that have no safety functions when switch is in hand position.
2. Connect selector switches in both hand and automatic positions for safety-type control devices such as low and high pressure cutouts, high temperature cutouts, and motor overload protectors.

3.4 CONNECTIONS

A. Conduit installation requirements are specified in other Division 26. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 26.

3.5 DISCONNECT SWITCHES

A. For each HVAC equipment item being furnished on the project the HVAC Trade shall:

1. Review/coordinate with the equipment manufacturer to determine whether a disconnect switch will be furnished with it.
2. Review the electrical drawings and/or coordinate with the Electrical Trade to determine whether the Electrical Trade will be providing a disconnect switch for the equipment item.

B. A disconnect switch shall be provided for each HVAC equipment item that has a 1-phase or 3-phase power connection. The HVAC Trade shall provide a disconnect switch for an equipment item unless one of the following occur:

1. The equipment manufacturer is required to furnish or provide a disconnect switch or a combination motor starter/disconnect for the equipment item.
2. The electrical drawings require the Electrical Trade to provide a disconnect switch for the equipment item.

C. Mount disconnect switch to the equipment item it serves. If a disconnect switch cannot be mounted to the equipment item it serves or the drawings indicate the disconnect switch to be mounted in a different location, mount switch in a location within 50 feet and within eyesight of the equipment item. Provide miscellaneous steel as required to mount the disconnect switch.

1. Bolt disconnect switches to equipment casing or to wall, or mount on free-standing lightweight structural steel channels and bolted to floor, equipment rails or roof curb.

3.6 FUSES

A. Fuses: Fuses shall be provided for each HVAC equipment item having power connection and requiring fuses. If fuses are not furnished with the HVAC equipment item, then the HVAC Trade shall provide all the necessary fuses for proper operation of the equipment and the electrical circuit.

1. Install fuses in each fusible switch. Comply with requirements in Division 26.

3.7 PIPING AND DUCTWORK COORDINATION

A. The HVAC Trade shall not run ductwork or piping above switchboards or panelboards in accordance with the National Electric Code Article 384. Before ductwork or piping is installed coordinate the exact locations with the Electrical Trade. Failure to comply with this requirement shall be cause for the ductwork and piping to be removed and relocated at no additional cost to the Owner.

END OF SECTION 23 0510

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Efficiency: NEMA Premium efficiency, as defined in NEMA MG 1.

1. Electric motors shall comply with the requirements of the Energy Policy Act of 1992.
2. Motors that are single-speed, polyphase, 1-500 horsepower, 2, 4, and 6 pole, squirrel cage induction type, NEMA Design A or B, continuous rated shall be NEMA Premium efficiency electric motors.

    a. NEMA Premium efficiency electric motors must meet or exceed the nominal energy efficiency levels presented below.

        1) The NEMA Premium efficiency levels are contained in NEMA Standards Publication MG 1-2006, in Tables 12-12 and 12-13, respectively.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104°F and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Service Factor: 1.15.

C. Rotor: Random-wound, squirrel cage.

D. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

E. Temperature Rise: Match insulation requirements.

F. Insulation: Class F.

G. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

H. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 SINGLE PHASE MOTORS

A. Motors larger than 1/20 HP shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

F. Electronic Commutation (EC) Motors: Each EC motor shall be specifically designed for its particular application. EC motors shall be permanently lubricated, shall have heavy-duty ball bearings to match the load, and shall be prewired to the specific voltage and phase. EC motors shall have internal motor circuitry to convert AC power supplied to DC power in order to properly operate the motor. EC motors shall be capable of having their speed controlled down to

20% of full speed (80% turndown). EC motor speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Each EC motor shall have a minimum efficiency of 85% at all speeds.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0513

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Certified TAB reports.

B. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB, AABC, or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB, AABC, or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB, AABC, or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms published by AABC or NEBB.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven (7) days advance notice to the Contractor and Owner prior to commencement of TAB work. Include scheduled test dates and times. Provide seven (7) days advance notice to any changes in the scheduled dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following independent TAB contractors to provide the TAB work:

1. Kahoe Air Balance Company
2. Northstar Environmental, Ltd.
3. Professional Balance Company
4. WAE Balancing, Inc.

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 TAB of systems and equipment. Notify contractor, Architect and Engineer immediately upon discovery of any deficiencies.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible. Notify contractor immediately upon discovery of any balancing devices not present that will prevent balancing of the system.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section 23 3113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

E. Verify that transfer ducts or penetrations in plenum walls exist to enable air flow through plenum as indicated or required.

F. Examine equipment performance data including fan and pump curves.

G. Obtain and examine start-up test reports to verify that start-up testing, cleaning, and adjusting of HVAC equipment and systems have been performed prior to the commencement of TAB work.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures to the contractor, Architect and Engineer.

3.2 PREPARATION

A. Complete system-readiness checks. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balancing, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING, ADJUSTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance," NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing," and the requirements contained in this Section.

B. Cut insulation, **d**ucts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

C. Mark equipment and balancing devices, including damper control positions, valve position indicators, fan speed control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Where the Drawings require the HVAC trade to demolish and/or modify only a portion of an existing air system and the remainder of the system is to remain in service, the Testing, Adjusting and Balancing (TAB) trade shall measure the air flow rates in the undisturbed portions of system prior to disconnecting work in the construction areas. The TAB trade shall rebalance the affected systems to these measurements immediately following the disconnection of the ductwork being demolished/modified and also immediately after placing the new/modified system into service.

B. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

D. Check airflow patterns from the outdoor air louvers and dampers and the return and exhaust air dampers through the supply fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air handling unit components.

K. Verify that air duct system is sealed as specified in Division 23 Section 23 3113 "Metal Ducts".

3.5 PROCEDURES FOR CONSTANT VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow at outlet of supply fans or inlet of exhaust fans using Pitot-tube traverse measurements.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. For each fan on the project, make adjustment of fan speed higher or lower than scheduled speed in order to achieve design airflow rates. Comply with requirements in Division 23 sections for air handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air handling unit performance.

    a. For each belt driven fan, provide one complete belt and sheave change in order to balance the fan to the design airflow rate.

b. Do not make fan speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts at terminal outlets and inlets without making adjustments and calculate the total airflow for that zone.

a. Measure terminal outlets using a direct reading hood or outlet manufacturer's written instructions and calculating factors.

2. Adjust volume dampers until the proper airflow rate for that zone is achieved.
3. Re-measure each sub-main and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger - test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal protection element rating.

3.7 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

1. Supply, Return, Relief and Exhaust Fans and Equipment with Fans: Zero to plus 5 percent of scheduled design flow.
2. Air Outlets and Inlets: Plus or minus 10 percent of design flow indicated.

3.8 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

3. Not all components listed below apply to this project. Provide data for each existing component, or component furnished to the jobsite as applicable.

B. Final Report Contents - in addition to certified field report data, include the following:

1. Field test reports (start-up reports) prepared by system and equipment installers.
2. Other information relative to equipment performance such as fan curves and pump curves; do not include Shop Drawings and product data.

C. General Report Data - in addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fan performance forms including the following:

    a. Settings for outdoor, return, and exhaust air dampers.
    b. Other system operating conditions that affect performance.

D. Fan Test Reports - for all exhaust fans include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches and bore.
    h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Voltage at each connection.
    e. Amperage for each phase.
    f. Discharge static pressure in inches wg (Pa).
    g. Suction static pressure in inches wg (Pa).

E. Fume Hood Device Reports - for each fume hood, include the following:

1. Unit Data:

    a. System and air handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.
    g. Type and model number.
    h. Size.
    i. Effective area in square feet.
    j. Design air flow rate in cfm.

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm.
    b. Air velocity in fpm.
    c. Preliminary air flow rate in cfm.
    d. Preliminary velocity in fpm.
    e. Final air flow rate in cfm.
    f. Final velocity in fpm.

3.9 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 0593

SECTION 23 0900 - AUTOMATIC TEMPERATURE CONTROL FOR HVAC

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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes control equipment for all HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.3 WORK INCLUDED

A. Automatic Temperature Control (ATC) Subcontractor shall:

1. Furnish and install control components required for the operation of the equipment provided on this project.

    a. Electronic actuation shall be employed.

2. Provide all power wiring, control wiring, and conduit for all DDC panels, application specific controllers, programmable controllers and DDC temperature control devices, except as detailed within. Provide all electrical work associated with the BAS control system and as called for on the Drawings including:

    a. Providing all line voltage and low voltage power wiring and conduit in accordance with all local codes, the National Electric Code (latest edition), and Division 26.
    b. Providing all line voltage and low voltage control wiring, concealed in conduit or exposed as plenum-rated cable, in accordance with local codes, the National Electric Code (latest edition), and Division 26.

        1) All low voltage electrical control wiring throughout the building shall be as described in Part 3 of this Section.

    c. Incorporating and providing surge transient protection in design of system to protect electrical components in all DDC Controllers, Application Specific Controllers, and operator interface devices.

3. Furnish all automatic air dampers, including actuators. Provide all power wiring, conduit and controls for automatic air dampers installed.
4. Provide a field technician to coordinate work with the Testing and Balancing technicians.
5. For all exhaust fans, provide all interlock power/control wiring and conduit between the fan and its motorized damper.
6. Perform functional performance testing for all controls installed.

B. The HVAC Trade shall:

1. Install all automatic air (outdoor air, return air, exhaust air, ventilation air) control dampers furnished by the ATC Subcontractor.
2. Provide all required access doors.

1.4 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. MS/TP: Master slave/token passing.

D. PC: Personal computer.

E. PID: Proportional plus integral plus derivative.

F. RTD: Resistance temperature detector.

1.5 SEQUENCE OF OPERATION

A. Refer to PART 4 of this section for required operating sequences for each HVAC system, equipment item and component.

1.6 GENERAL PRODUCT DESCRIPTION

A. The building automation system shall consist of the following:

1. Stand-alone Application Specific DDC Controllers (ASCs).

B. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Application Specific Controllers and operator devices.

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

D. The DDC system hardware and software installed for this project must maintain compatibility with systems developed in the future. It is a requirement that the ATC Subcontractor support this "Forward and Backward Compatibility" claim with written company literature and local references of facilities where the company's former DDC system ties into their current DDC system.

1.7 QUALITY ASSURANCE

A. Materials and equipment shall be the catalogued products of the manufacturer. The ATC Subcontractor personnel shall have been regularly engaged in production and installation of automatic temperature control systems for a minimum of 5 years. The control system shall be the manufacturer's latest standard design that complies with the specification requirements.

B. Install system using competent workers who are regularly employed and fully trained by the ATC Subcontractor in the installation of temperature control equipment. The ATC shall provide adequate staff to engineer, supervise, program and commission the control system in a timely manner. In addition, ATC shall maintain fully equipped service trucks to provide full warranty service available 24 hours a day, 7 days a week with a minimum 4-hour response time.

C. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system.

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. Electronic equipment shall conform to the requirements all government regulations.

1.8 SUBMITTALS

A. Manufacturer's Product Data including:

1. Hardware--cut sheets, product descriptions, and engineering information.
2. Engineering--design requirements for initial installations and/or additions to existing systems.
3. Installation--mounting and connection details for field hardware, accessories, and central site equipment.
4. Field hardware set-up, checkout, and tuning techniques.

B. Shop Drawings:

1. Drawings shall show proposed layout and installation of all equipment and the relationship to other parts of the work. Shop drawings shall include the following:

   a. Bill of materials of equipment indicating quantity, manufacturer, and model number.
   b. Schematic flow diagrams of:

      1) Each controlled HVAC equipment item showing components fans, dampers**,** and control devices.

   c. Complete wiring diagrams showing all power, signal, and control wiring. Include wire types.
   d. Details of control panel faces, including controls, instruments, and labeling.
   e. Written description of sequence of operation.
   f. Schedule of dampers including size, leakage, and flow characteristics. Include damper size and type, actuator type, torque and damper actuator part numbers.
   g. Points list for each HVAC system or HVAC equipment item being controlled.
   h. Tag number of devices and any other details required to demonstrate that the system will function properly.

2. Shop drawings shall clearly indicate intended sequence of operation for all equipment.

C. Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Architect/Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

1.9 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Submit operation and maintenance data under provisions of Division 01.
2. Include systems descriptions, set points, and controls settings and adjustments.
3. Include inspection period, cleaning methods, recommend cleaning materials, and calibration tolerances.
4. Provide owner instruction under provisions of Division 01. Use operation and maintenance data as a training manual.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01.

B. Include systems descriptions, set points, and controls settings and adjustments.

C. Include inspection period, cleaning methods, recommend cleaning materials, and calibration tolerances.

D. Provide owner instruction under provisions of Division 01. Use operation and maintenance data as a training manual.

1.11 SEQUENCING, SCHEDULING, AND COORDINATION

A. Coordinate work under provisions of General and Supplementary Conditions, Division 01 and Division 23, and ensure system is completed and commissioned by Date of Substantial Completion.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.13 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with Owner and Architect before installation. Obtain approval for final locations from Owner and Architect prior to installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Owner shall have full rights to all programming software and to all passwords.

B. All DDC controllers must have proportional-integral (PI) or proportional-integral-derivative (PID) algorithms incorporated into their programming.

2.2 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

B. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide each central system controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM or a minimum of 72-hour battery backup shall be provided. All programs shall be field-customized to meet the user's exact control strategy requirements.

C. Local alarming and trending capabilities shall be provided for convenient troubleshooting and system diagnostics. Alarm limits and trend data information shall be user-definable for any point.

D. Each controller shall have connection provisions for a portable operator's terminal. This tool shall allow the user to display, generate or modify all point databases and operating programs. All new values and programs may then be restored to EEPROM via the programming tool.

E. Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type providing the following minimum performance requirements are met:

- ♦ Accuracy: ± 0.5°F
- ♦ Operating Range: 35° to 115°F
- ♦ Set Point Adjustment Range: 55° to 95°F
- ♦ Set Point Modes: Independent Heating, Cooling, Night Setback-Heating, Night Setback-Cooling
- ♦ Calibration Adjustments: None required
- ♦ Installation: Up to 100 ft. from Controller

1. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. In lieu of an internal jack, provide a separate terminal jack mounted on a stainless steel wall plate adjacent to the sensor to facilitate direct access to the controller via the terminal.
2. Each room sensor shall also include the following auxiliary devices: Setpoint Adjustment Dial, Temperature Indicator, and Override Switch.

    a. The setpoint adjustment dial shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at a web-based workstation, DDC Controller, or via the portable operator's terminal.
    b. An override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, DDC Controller or via the portable operator's terminal.

3. Provide flush-mount type sensors for all rooms. These shall be Siemens model 540-520 or equivalent.
4. Coordinate the final check-out of the terminal units with the Testing and Balancing Subcontractor.

F. Each controller shall perform its primary control function independent of other DDC controller or if communication is interrupted. Reversion to a fail-safe mode of operation during communications interruption is not acceptable. The controller shall receive its real-time data from the DDC Network Panel time clock to insure continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings.

2.3 FIELD DEVICES AND EQUIPMENT

A. Automatic Air Dampers:

1. Provide opposed blade dampers as shown on Drawings. Dampers shall be AMCA 500 rated and operate within a temperature range of -40° to 200°F.

2. Standard Automatic Air Dampers:

   a. Extruded aluminum (6063T5) damper frame shall not be less than .080-inches in thickness. Damper frame to be 4-inches deep.
   b. Blades to be extruded aluminum (6063T5) profiles.
   c. Blade seals shall be of extruded EPDM. Frame seals shall be extruded silicone. Seals shall be secured in an integral slot within the aluminum extrusions.
   d. Bearings shall be composed of a Celcon inner bearing fixed to a 7/16-inches aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.
   e. Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
   f. Dampers are to be designed for operation in temperatures ranging between -40°F and 212°F.
   g. Dampers shall be available with either opposed blade action or parallel blade action.
   h. Leakage shall not exceed 3 cfm/ft² (15.2 l/s/m²) against 1" (.25 kPa) w.g. differential static pressure.
   i. Pressure drop of a fully open 48-inches x 48-inches damper shall not exceed 0.02-inches w.g. (.004-kPa) at 1000 fpm (5.08 m/s).
   j. Dampers shall be made to size required without blanking off free area.
   k. Dampers shall have flanges.
   l. For dampers that consist of two or more sections in both height and width, intermediate or tubular steel structural support shall be provided to resist applied pressure loads.
   m. Installation of dampers must be in accordance with current manufacturer's installation guidelines provided with each shipment of dampers. Technical information available on the damper manufacturer's website shall supersede and take precedence over all information contained within its printed catalog if the information on its website is more current.
   n. Standard automatic air dampers shall be TAMCO Series 1000 Air-Foil Control Damper, as manufactured by T. A. Morrison & Co., Inc. and as supplied by BCS, Inc. (Tel: 412-279-7774), or approved equal.

3. Low Temperature Thermally Broken Automatic Air Dampers:

   a. Extruded aluminum (6063T5) damper frame shall not be less than .080-inches in thickness. Damper frame shall be 4-inches deep.
   b. Entire frame shall be thermally broken by means of polyurethane resin pockets, complete with thermal cuts.
   c. Blades shall be extruded aluminum (6063T5) profiles, internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.
   d. Blade and frame seals shall be of extruded silicone and be secured in an integral slot within the aluminum extrusions.
   e. Bearings shall be composed of a Celcon inner bearing fixed to a 7/16-inches aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact
   f. Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
   g. Dampers shall be designed for operation in temperatures ranging between -40°F and 185°F.
   h. Dampers shall be available with either opposed blade action or parallel blade action.
   i. Leakage shall not exceed 3 cfm/ft² against 1-inch w.g. differential static pressure.
   j. Pressure drop of a fully open 48-inches x 48-inches damper shall not exceed 0.03-inches w.g. at 1000 fpm.
   k. Dampers shall be made to size required without blanking off free area.
   l. Dampers shall have flanges.
   m. For dampers that consist of two or more sections in both height and width, intermediate or tubular steel structural support shall be provided to resist applied pressure loads.

n. Installation of dampers must be in accordance with current manufacturer's installation guidelines provided with each shipment of dampers. Technical information available on the damper manufacturer's website shall supersede and take precedence over all information contained within its printed catalog if the information on its website is more current.

o. Low temperature thermally broken automatic air dampers shall be TAMCO Series 9000BF Thermally Insulated Control Damper with Thermally Broken Frame, as manufactured by T. A. Morrison & Co., Inc. and as supplied by BCS, Inc. (Tel: 412-279-7774), or approved equal.

B. Damper Actuators:

1. Size for torque required for damper seal at maximum design conditions.
2. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle; directly couple and mount to the valve bonnet stem; or ISO-style direct-coupled mounting pad.
3. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
4. Overload Protection: The actuator shall be overload protected electronically throughout rotation.
5. Fail Safe Operation: Mechanical fail safe shall incorporate a spring-return mechanism. Electronic fail safe shall incorporate an active balancing circuit to maintain equal charging rates among the super capacitors with a visual indication of the fail-safe status on the actuator face, and with the following:

    a. Power fail position field adjustable between 0 to 100% in 10-degree increments
    b. A 2-second operational delay, field adjustable between 0 and 10 seconds
    c. Capability of changing the fail-safe position through an integrated switch without removing the mounted actuator.

6. Power Requirements: 24-volts AC/DC or 120-volts AC
7. Proportional Actuators shall be software configurable through an EEPROM without the use of actuator mounted switches. Programmable functions shall include a scalable operating range from 0.5 - 32.0 volts DC with a 2.0 volt DC (min) span; variable runtime; and data logging.
8. Temperature Rating: -22°F to +122°F
9. Housing: NEMA type 2 for indoor locations and NEMA type 4X for outdoor locations.
10. Actuator shall be UL listed.
11. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
12. Provide binary damper position feedback contacts for 2-position dampers and analogue damper position feedback contacts for modulating dampers.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Verify location of exposed control sensors with Drawings and room details before installation. Also, confirm locations of exposed control sensors with Architect and/or Owner prior to rough-in. Install devices 48 inches above the floor to comply with ADA requirements.

C. Locate all control panel enclosures within mechanical or electrical equipment rooms.

1. Consideration may be given to locating control panel enclosures in spaces other than mechanical or electrical equipment rooms that are typically unoccupied, such as Storage Rooms, Janitor Closets, etc. The ATC Subcontractor must coordinate and obtain approval for each proposed location with the Architect and/or Owner prior to installation.
2. Under no circumstances shall control panel enclosures be installed in finished rooms or rooms intended for occupancy unless such locations are specifically requested by the Owner.

D. Connect and configure equipment and software to achieve sequence of operation specified.

3.2 AUTOMATIC AIR DAMPER INSTALLATION

A. Install automatic air dampers where required by PART 4 of this section:

1. Install standard automatic air dampers in supply airstreams and return airstreams where both sides of the damper will be exposed to conditioned air.
2. Install low temperature thermally broken automatic air dampers in exhaust airstreams, outdoor airstreams and relief airstreams where one side of the damper will be exposed to ambient conditions or unconditioned air.

B. Install damper motors on outside of duct in warm areas only. Do not install damper motors in locations exposed to outdoor temperatures.

3.3 WIRING INSTALLATION

A. Run all line voltage control wiring in conduit in accordance with the National Electric Code and the requirements specified in Division 26, Sections “Basic Electrical Requirements;” “Basic Electrical Materials and Methods,” “Raceways;” “Wires and Cables;” “Cabinets, Boxes, and Fittings;” “Supporting Devices;” and “Electrical Identification.”

B. Power for controls shall be obtained from the nearest normal/emergency power panel.

C. All low voltage power wiring shall be as described below:

1. Provide "plenum-rated" cable for low voltage wiring.

   a. Except where otherwise prohibited by applicable codes, conductors and cables operating at less than 30 volts and having "plenum type" insulation listed for compliance with NEC Article 300-22(c) are permitted to be installed without raceways above accessible suspended acoustic ceilings. Accessible suspended ceilings are defined as those having access panels, unsplined tiles for access purposes, and unclipped lay-in tiles for access purposes, or other approved access means at intervals of not more than 20 feet from one another.
   b. Where conductors or cables are installed in compliance with the above, the cables shall be neatly supported clear of the ceiling system by means of approved pre-formed nylon tie devices. Supports shall be accessible. Maintain a minimum spacing of than 18" between parallel runs of control wiring and wiring of other systems.

2. Run control wiring in EMT conduit in Mechanical rooms and other exposed wall and ceiling locations.

D. Connect manual-reset limit controls independent of manual control switch positions.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 ADJUSTING

A. Calibrating and Adjusting

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

4. Flow:

    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.

5. Pressure:

    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

6. Temperature:

    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.

7. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
8. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
9. Provide diagnostic and test instruments for calibration and adjustment of system.
10. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

3.5 DEMONSTRATION

A. Provide all verification testing prior to functional performance testing.

B. Provide systems demonstration under provisions of Division 01.

C. Demonstrate complete operation of systems including Sequence of Operation after Date of Substantial Completion. The Owner or his appointed representative shall be given the opportunity to witness the functional performance testing and the successful demonstration of the operating sequences. The ATC Subcontractor shall provide the Owner or his appointed representative a minimum of 14-days notice prior to functional performance testing. Also, the ATC Subcontractor shall provide the Owner or his appointed representative a minimum of 14-days notice prior to demonstration of the operating sequences.

3.6 ON-SITE TESTING

A. Provide Engineer-approved operation and acceptance testing of the complete system. Complete Functional Test Checklist as outlined at end of this section for each piece of mechanical equipment controlled by ATC on this project. The Engineer, the Owner, and/or Owner representative may witness all tests and shall be given sufficient notice prior to any tests being conducted.

B. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Provide a detailed cross-check of each sensor within the system by making a comparison between the reading at the sensor and a standard traceable to the National Bureau of Standards.

C. Provide a cross-check of each control point within the system by making a comparison between the control command and the field-controlled device. For each DDC Controller test DDC software sequence to confirm a match with design sequence. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Submit the results of functional and diagnostic tests and calibrations to the Engineer for final system acceptance as shown on Functional Test Checklist.

D. Compliance Inspection Checklist: Submit the requested items of information to the Owner's Representative and Architect/Engineer for verification of compliance to the project specifications. Failure to comply with the specified information shall constitute non-performance of the contract. The Subcontractor shall submit written justification for each item in the checklist that he is unable to comply with. The Owner's Representative and the Architect/Engineer will initial and date the checklist to signify Subcontractor's compliance before acceptance of system.

3.7 SERVICE AND GUARANTEE

A. General Requirements: Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of two years after completion of successful performance test. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work. Without additional cost, provide software upgrades issued during the warranty period.

B. Description of Work: The adjustment and repair of the system includes all computer equipment, software updates, transmission equipment and all sensors and control devices. Provide the manufacturer's required adjustments and all other work necessary.

C. Personnel: Provide qualified personnel to accomplish all work promptly and satisfactorily. Owner shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

D. Emergency Service: Owner will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the complete system. Furnish owner with a telephone number where service representative can be reached at all times. Service personnel shall be at the site within 8 hours after receiving a request for service. Restore the control system to proper operating condition within 24 hours.

E. Operation: Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the initial performance test.

F. Systems Modifications: Provide any recommendations for system modification in writing to Owner. Do not make any system modifications, including operating parameters and control settings, without prior approval of Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

G. Software: Provide all software updates during the warranty period and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and shall be incorporated into the operations and maintenance manuals, and software documentation.

3.8 TRAINING

A. The ATC Subcontractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. It is the intent of the Owner to become thoroughly versed in the operation and programming of the DDC system so as to make full use of system capabilities and be able to revise graphics. All information and documentation necessary to do this work must be provided.

1. Provide 8-hours of on-site training for Owner's operating personnel. Coordinate/Schedule training sessions with the Owner a minimum of 14-days in advance. Training shall include:

    a. Explanation of drawings, operations, and user manuals
    b. Walk-thru of the job to locate control components
    c. Explanation of manual and automatic control devices
    d. DDC Controller and ASC operation/function
    e. Explanation of maintenance manuals
    f. Explanation of adjustment, calibration, and replacement procedures

PART 4 - SEQUENCE OF OPERATION

4.1 EXHAUST FANS

A. Damper Control: Each fan shall be provided with a motorized damper or automatic air damper.

1. All centrifugal roof exhaust fans shall be provided with a motorized damper. The ATC Subcontractor shall coordinate the furnishing of the motorized dampers with the HVAC Trade and the exhaust fan supplier.

a. The ATC Subcontractor shall install all motorized dampers in the throat of the roof curb.
b. The ATC Subcontractor shall provide power to each motorized damper and the damper shall be controlled so that it is open when the fan is operating and it is closed when the fan is not operating.

B. Manual Control: The ATC Subcontractor shall provide all interconnecting control wiring between the ON/OFF switch and fan.

1. ON/OFF Switch: The fans indicated to have a switch in the schedule on the drawings shall be started and stopped via an ON/OFF switch. The fume hood shall be provided with an integral fan switch. Fume hood and switch are provided by others.

END OF SECTION 23 0900

SECTION 23 3113 - METAL DUCTS

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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.

1.3 PERFORMANCE REQUIREMENTS

A. 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 the "Duct Schedule" Article in this Section.

PART 2 - PRODUCTS

2.1 SINGLE-WALL 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 1-4, "Transverse (Girth) 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 1-5, "Longitudinal Seams - Rectangular Ducts," 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 2, "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."

2.2 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: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. 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.

D. 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 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. Also, sealants and gaskets shall conform to UL 181A for metal ducts and UL 181B for flexible air ducts and flexible air connectors.

1. Closure systems uses to seal ductwork listed and labeled in accordance with UL 181A shall be marked “181A-P” for pressure sensitive tape, “181A-M” for mastic, or “181A-H” for heat sensitive tape. Closure systems uses to seal flexible air ducts and flexible air connectors shall comply with UL 181B shall be marked “181B-FX” for pressure sensitive tape, or “181B-M” for mastic.

B. Water Based Joint and Seam Sealant:

1. Type: Vinyl Acetate.
2. Solids Content: 69.2 percent.
3. Weight: 11.6 .2 lbs./gallon
4. Color: Grey.
5. Odor: Mild/Wet; Bland/Dry.
6. VOC: 22 gms./ltr.
7. Viscosity: 140,000-180,000 CPS # 7 Brookfield, 20 RPM at 70°F.
8. Flammability: Non-Flammable.
9. Effect of Freezing: No damage - 3 Cycles.
10. Service: Indoor and outdoor use.
11. Storage Life: 6 Months at 70°F.
12. Cure Time: 48 hours.
13. Method of Application:

    a. Brush, trowel, putty knife or caulking gun.

14. Product: Sealant shall be equivalent to Duro Dyne DDS-181.

C. 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.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports:

1. Supports for Galvanized steel Ducts: Galvanized steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCTWORK - GENERAL

A. Do not install ductwork in transformer vaults, elevator equipment rooms or electrical equipment rooms unless the ductwork serves HVAC equipment located in that room and is dedicated to provide cooling and/or heating to that room. Do not install ductwork adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.

3.2 PROTECTION OF DUCT

A. Immediately after fabrication, the duct shall be cleaned of all dirt, dust and debris. The ends of the duct section shall then be securely covered with plastic and strapping tape. The duct shall then be completely covered with cloth or plastic.

B. When each duct section transported to the job site, the covering over the ends of each duct shall be maintained to prevent the entrance of dirt, dust and debris. In addition, all ducts shall be covered with plastic or cloth.

C. Immediately after the duct arrives at the job site and prior to being installed, the covering over the ends of each duct shall be maintained to prevent the entrance of dirt, dust and debris. In addition, all ducts shall be covered with plastic or cloth.

D. When each duct is installed, the plastic covering shall be removed. Once installed, the duct section shall be inspected for the existence of dirt or dust; if discovered, the duct section shall be cleaned of all dirt and dust. Unless the next section of duct is in the process of being installed, the end of the duct shall securely covered with plastic and strapping tape.

3.3 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 ducts with fewest possible joints.

D. Install factory or shop fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a minimum clearance of 1 inch plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. 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.

J. Where ducts pass through fire rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section 23 3300 "Air Duct Accessories" for fire and smoke dampers.

3.4 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. Closure systems used to seal metal ductwork shall be installed in accordance with the manufacturer’s installation instructions.

C. Unlisted duct tape is not permitted as a sealant on any metal ducts.

D. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened.

1. Mechanical fasteners for use with flexible non-metallic air ducts shall comply with UL 181B and shall be marked “181B-C.”

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Ducts shall be supported directly from the building substrate. Ducts are not permitted to be supported from other ducts, pipes, conduits, or cable tray.

C. Building Attachments: Structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

D. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.

E. Hangers Exposed to View: Threaded rod and angle or channel supports.

F. 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 interval of 16 feet.

G. 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.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section 23 3300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 DUCT SCHEDULE

A. Duct Material - fabricate ducts with galvanized sheet steel.

B. Duct Pressure Class, SMACNA Seal Class, and SMACNA Leakage Class: Fabricate ducts for the following pressure, seal and leakage classes:

1. Fume Hood Exhaust Air Ductwork:

a. Pressure Class: Negative 2-inches wg, 3-inches wg, or 4-inches wg.
b. Seal Class: A, B or C.
c. SMACNA Leakage Class for Rectangular: 24, 12 or 6.
d. SMACNA Leakage Class for Round and Flat Oval: 12, 6 or 3.

C. Intermediate Reinforcement:

1. Galvanized steel Ducts: Match duct material.

END OF SECTION 23 3113

SECTION 23 3300 - 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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Control dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct mounted access doors.
5. Flexible connectors.
6. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data - submit manufacturer's published data for each type of product indicated.

1. Control dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct mounted access doors.
5. Flexible connectors.
6. Duct accessory hardware.

B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

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."

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized sheet metal ducts.

D. 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.

2.2 CONTROL DAMPERS

A. Control dampers shall be furnished by the Automatic Temperature Control Subcontractor. Refer to Division 23 Section 23 0900 “Automatic Temperature Control for HVAC” for requirements.

2.3 FLANGE CONNECTORS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.4 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: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

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: Single wall.

2.5 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. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation
7. McGill AirFlow, LLC
8. Nailor Industries Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, 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. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.6 FLEXIBLE CONNECTORS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. 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 having a minimum width of 5-3/4 inches 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°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°F.

G. High Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd.
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67° to plus 500°F.

H. High Corrosive Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd.
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67° to plus 500°F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.7 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.

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 control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install turning vanes in all mitered rectangular duct elbows with an angle greater than 45°.

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 duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Downstream from control dampers.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes: Access doors shall be sized as large as possible and practical, but shall not be less than 12 x 6 inches and shall not be greater than 25 x 25 inches.

J. Install flexible connectors to connect ducts to equipment.

1. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

K. Connect flexible ducts to metal ducts with nylon draw bands.

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.
3. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 3300

SECTION 23 3423 - HVAC POWER VENTILATORS

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.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include plans, elevations, sections, details, and attachments to other work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. In addition, include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.
8. Wiring Diagrams: For power, signal, and control wiring.

B. Field quality control reports.

C. Operation and Maintenance Data: For each power ventilator, include in emergency, operation, and maintenance manuals.

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. AMCA Compliance: Fans shall have AMCA Certified performance ratings and shall bear the AMCA Certified Ratings Seal.

1.6 COORDINATION

A. Coordinate size and location of structural steel support members.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

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. Belts: One set for each belt driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation
2. Loren Cook Company
3. PennBarry
4. Twin City Fan & Blower

B. Housing: The housing shall be a removable, spun-aluminum or galvanized steel, dome top with a square, one-piece, aluminum base and a venturi inlet cone.

1. Hinged Subbase: Galvanized steel hinged arrangement permitting service and maintenance.
2. Up blast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Motors:

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section 23 0513 "Common Motor Requirements for HVAC Equipment."

a. Motor Sizes: Minimum size as indicated in the schedule on the Drawings. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

b. .
c. Electrical Devices and Wiring: Comply with requirements for electrical devices and connections specified in Division 26.

2. Enclosure Type: Open drip-proof (ODP) or totally enclosed, fan cooled (TEFC).

E. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

F. Adapter Roof Curbs: Galvanized steel; mitered and welded corners; 1½-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1½-inch wood nailer. Size as required to mate to the existing roof curb.

1. Metal Liner: Galvanized steel.

G. Isolation: Blower and motor shall be mounted on rubber isolators that isolate them from the fan housing.

H. Accessories:

1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, ½-inch mesh, aluminum or brass wire.
3. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

I. Controls: Refer to Division 23 Sections 23 0900 “Automatic Temperature Control for HVAC” for requirements.

J. Capacities and Characteristics: Refer to the schedule on the drawings.

2.2 QUALITY CONTROL

A. Certify sound power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof mounted fans to roof curbs with cadmium-plated hardware. Refer to Division 07 for installation of roof curbs.

C. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section 23 3300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Sections.

D. Connect wiring according to Division 26 Sections.

3.3 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. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 Section 23 0593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain power ventilators. Refer to Division 01 for additional requirements.

END OF SECTION 23 3423

SECTION 26 0100 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 09 FINISHES Sections.

1.2 SUMMARY

A. This Section includes general administrative, procedural requirements, construction materials and construction methods for electrical installations. The following requirements are included in this Section to expand the requirements specified in Division 01 - reference individual sections for further expansion of these requirements:

1. Abbreviations and Acronyms
2. Definitions
3. Permits, Codes, and Inspections
4. Visiting Premises
5. Project Drawings and Specifications
6. Nameplate Data
7. Coordination
8. Substitutions
9. Submittals
10. Quality Assurance and Testing
11. Temporary
12. Delivery, Storage, and Handling
13. Cutting and Patching
14. Installations
15. Final Cleaning
16. Warranties
17. Maintenance Manuals
18. Record Documents
19. Demonstration and Training

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
2. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
3. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
4. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
5. AIA - American Institute of Architects (The); www.aia.org.
6. AISC - American Institute of Steel Construction; www.aisc.org.
7. AISI - American Iron and Steel Institute; www.steel.org.

8. ANSI - American National Standards Institute; www.ansi.org.
9. APA - Architectural Precast Association; www.archprecast.org.
10. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
11. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
12. ASSE - American Society of Safety Engineers (The); www.asse.org.
13. ASTM - ASTM International; www.astm.org.
14. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
15. AWEA - American Wind Energy Association; www.awea.org.
16. BICSI - BICSI, Inc.; www.bicsi.org.
17. CDA - Copper Development Association; www.copper.org.
18. CEA - Consumer Electronics Association; www.ce.org.
19. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
20. CSA - CSA Group; www.csa.ca.
21. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
22. CSI - Construction Specifications Institute (The); www.csinet.org.
23. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
24. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
25. DHI - Door and Hardware Institute; www.dhi.org.
26. DOE - Department of Energy; www.energy.gov.
27. ECA - Electronic Components Association; (See ECIA).
28. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
29. ECIA - Electronic Components Industry Association; www.eciaonline.org.
30. EIA - Electronic Industries Alliance; (See TIA).
31. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
32. EPA - Environmental Protection Agency; www.epa.gov.
33. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
34. ESTA - Entertainment Services and Technology Association; (See PLASA).
35. ETL - Intertek (See Intertek); www.intertek.com.
36. FAA - Federal Aviation Administration; www.faa.gov.
37. FM Approvals - FM Approvals LLC; www.fmglobal.com.
38. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
39. GSA - General Services Administration; www.gsa.gov.
40. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
41. HUD - Department of Housing and Urban Development; www.hud.gov.
42. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
43. ICBO - International Conference of Building Officials; (See ICC).
44. ICC - International Code Council; www.iccsafe.org.
45. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
46. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
47. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
48. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
49. IESNA - Illuminating Engineering Society of North America; (See IES).
50. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
51. ISO - International Organization for Standardization; www.iso.org.
52. ITU - International Telecommunication Union; www.itu.int/home.
53. LPI - Lightning Protection Institute; www.lightning.org.
54. MCA - Metal Construction Association; www.metalconstruction.org.
55. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
56. MHIA - Material Handling Industry of America; www.mhia.org.
57. MPI - Master Painters Institute; www.paintinfo.com.
58. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
59. NBI - New Buildings Institute; www.newbuildings.org.
60. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.

61. NCMA - National Concrete Masonry Association; www.ncma.org.
62. NECA - National Electrical Contractors Association; www.necanet.org.
63. NEMA - National Electrical Manufacturers Association; www.nema.org.
64. NETA - InterNational Electrical Testing Association; www.netaworld.org.
65. NFHS - National Federation of State High School Associations; www.nfhs.org.
66. NFPA - National Fire Protection Association; www.nfpa.org.
67. NICET - National Institute for Certification in Engineering Technologies.
68. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
69. NSPE - National Society of Professional Engineers; www.nspe.org.
70. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
71. OSHA - Occupational Safety & Health Administration; www.osha.gov.
72. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
73. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
74. RoHS – Restriction of Hazardous Substances
75. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
76. SIA - Security Industry Association; www.siaonline.org.
77. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
78. SPIB - Southern Pine Inspection Bureau; www.spib.org.
79. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
80. SSINA - Specialty Steel Industry of North America; www.ssina.com.
81. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
82. STI - Steel Tank Institute; www.steeltank.com.
83. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
84. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
85. UL - Underwriters Laboratories Inc.; www.ul.com.
86. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
87. USGBC - U.S. Green Building Council; www.usgbc.org.
88. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
89. WASTEC - Waste Equipment Technology Association; www.wastec.org.

1.4 DEFINITIONS

A. Basic Contract definitions are included in the Conditions of the Contract.

1. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, 'approved' is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
2. Concealed: Embedded in masonry or other construction, installed behind wall furring or within double partitions or installed within hung ceilings.
3. Conduit: The inclusion of all fittings, hangers, supports, sleeves, etc.
4. Contractor: As stated herein shall mean Electrical Contractor.
5. Directed: A command or instruction by Architect. Other terms including 'requested,' 'authorized,' 'selected,' 'required,' and 'permitted' have the same meaning as 'directed.'
6. Equal: Equivalent as approved by the Architect or their representative.
7. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
8. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including 'shown,' 'noted,' 'scheduled,' and 'specified' have the same meaning as 'indicated.'
9. Install: Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
10. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
11. Provide: Furnish and install, complete and ready for the intended use.
12. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

13. Wiring: The inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such work.

1.5 PERMITS, CODES, AND INSPECTIONS

A. Contractor shall obtain and pay for all permits and inspections required by laws, ordinances, rules, and regulations having jurisdiction for work included under this Contract, and shall submit approval certificates to the Architect.

B. The electrical installation shall comply fully with

1. All local, county and state laws, ordinances and regulations having jurisdiction and as applicable to the electrical installations.
2. All requirements of electric, telephone, and CATV utility companies.
3. All approved published instructions set forth by equipment manufacturers.

C. The Electrical installation and all components shall be in compliance with the code and/or standard requirements of the latest revision or state-adopted edition of:

1. American Society for Testing and Materials (ASTM)
2. Americans with Disabilities Act (ADA)
3. FM Global (Factory Mutual) Approval Guide
4. Institution of Electrical and Electronic Engineers (IEEE)
5. International Building Code (IBC)
6. International Fire Code (IFC)
7. International Energy Conservation Code (IECC)
8. Legislative Act 235 (1965) - Handicapped
9. Legislative Act 287 (1974) - Excavation
10. National Electric Code (NEC)
11. National Electrical Contractors Association (NECA)
12. National Electrical Manufacturer's Association (NEMA)
13. National Electrical Safety Code (NESC)
14. National Fire Protection Association (NFPA)
15. National Safety Code
16. Occupational Safety and Health Act (OSHA)
17. Underwriter's Laboratories, Inc. (UL)

D. Submit certificates issued by approved authorized agencies to indicate conformance of all work with the above requirements, as well as any additional certificates as may be required for the performance of this contract work.

E. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architect prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect and at no additional cost to the Owner.

F. Certificate of Inspection: The Contractor shall procure and pay for the Certificate of Inspection from the municipality-approved inspection agency and deliver it to the Architect before final payment is made.

1.6 VISITING PREMISES

A. The Bidder shall visit the project site before submitting his bid, in order to familiarize himself with existing conditions that may affect his work. It is the Contractor's responsibility to analyze existing conditions. Sufficient allowances shall be provided in the Contractor's bid to cover work, due to existing conditions, that will be required to complete this contract work.

B. By submission of a bid, the Contractor is attesting that responsible personnel did in fact visit the site during the bidding period and verified all existing pertinent conditions.

C. Contractor shall verify all measurements and dimensions at the site prior to submitting a bid.

1.7 PROJECT DRAWINGS AND SPECIFICATIONS

A. Contractor shall carefully examine the Drawings and Specifications of all trades and report all discrepancies to the Architect in writing to obtain corrective action. No departures from the Contract Documents will be made without prior written approval from the Architect.

B. Questions or disputes regarding the intent or meaning of Contract Documents shall be resolved by the interpretation of the Architect. The Architect's interpretation is final and binding.

C. The Drawings and Specifications are not intended to define all details, finish materials, and special construction that may be required or necessary. The Contractor shall provide all installations complete and adequate as implied by the project documents.

D. Drawings are diagrammatic only and do not show exact routes and locations of equipment and associated wiring. The Contractor shall verify the work of all other trades and shall arrange his work to avoid conflicts. In the event of a conflict, the Contractor shall obtain corrective action from the Architect.

E. All work shall be considered new, unless noted otherwise.

F. Prior to the submitting of bids, the Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment by all trades that will require electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment for which Underwriter's Laboratories have established standards shall bear a UL label of approval.

B. When two or more items of same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, and similar items used in work, except as otherwise indicated.

C. Provide products that are compatible within systems and other connected items.

D. In all cases where a device, function or item of equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation.

E. All listed materials and equipment shown on drawings and/or specified herein, are indicative of complete and whole units and shall be furnished as such.

F. In certain instances, specific manufacturer/model/type and catalog numbers are set out herein or on the drawings for the purpose of indicating required criteria for quality, function, sound level and acceptable physical size. Specifications, performance data, and descriptive data published by the designated manufacturer shall be taken as minimum requirements for the item to be provided.

G. Comply with manufacturer's printed instructions and recommendations as minimum criteria for the installation of equipment.

H. Where proprietary names are used, whether or not followed by the words "or as approved", they shall be subject to substitution only as approved by the Architect.

I. All materials and equipment provided under this Contract shall be completely satisfactory and acceptable in operation, performance and capacity. No approval, either verbal or written, of any drawing, descriptive data or samples of such materials, equipment and/or appurtenances, shall relieve this Contractor of his responsibility to turn over all items in perfect working order at completion of the work.

J. All material and equipment to be furnished under this contract shall be new and shall conform to the grade, quality and standards specified herein. Items of equipment shall be the latest standard product as advertised in printed catalogues by reputable manufacturers for the purpose intended and shall have replacement parts available.

2.2 NAMEPLATE DATA

A. Provide factory-installed, permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.

PART 3 - EXECUTION

3.1 GENERAL

A. All construction under this contract shall be completed in a neat and craftsman-like manner. Work that, in the judgement of the Architect, is not satisfactorily installed shall be removed and replaced to the Architect's satisfaction, at the Contractor's expense.

B. Throughout construction, all work areas and storage areas shall be kept clean. The Contractor shall keep all items clean of dirt, rust, dust and fingermarks.

C. The Contractor shall furnish, set, erect, and maintain all scaffolding, aerial equipment and ladders required in the installation of this Contract work.

D. Install temporary platforms so as to be supported only by the existing steel truss framework.

E. Painting: Provide in accordance with Division 09 FINISHES Sections and as stated below.

1. Except in Mechanical Rooms, Electrical Rooms, attics, and chase spaces all exposed items provided or installed under this Contract shall be painted.
2. Unless painting is provided by others as elsewhere specified, all painting for items furnished or installed under this Contract shall be the responsibility of this Contractor.
3. Factory-painted equipment cabinets and trim shall not be field-painted except for touching up scratches or damage where necessary to achieve like-new finish. Touching up shall be done after equipment is in its final location.
4. Paint for metal surfaces shall be Rust-o-leum or as approved, one prime coat and two finish coats of color selected by Architect.
5. Items to be painted shall be cleaned and degreased and shall be free of dirt, rust and corrosion prior to application of paint. All paint shall be applied in accordance with all the manufacturer's recommendations (i.e. temperature, dew point, ventilation).
6. All patchwork performed under this Contract shall be painted. Color shall match the color of adjacent walls, ceilings and floors in which patchwork occurs. Area to be painted shall extend a minimum of 24" all around patchwork; however, final limit shall be set by the Architect. Blend new paint work with existing painted surfaces. Where existing finish is stained or varnished woodwork, all damaged or patched surfaces shall be restored to match the existing adjacent surface, as approved. Paint, stain, varnish and method of application shall be as set out in the specifications for General Construction, or as otherwise approved. Except where

painting of patchwork is provided by others, as elsewhere specified, all painting of patchwork required under this Contract shall be the responsibility of this Contractor.

3.2 COORDINATION

A. Sequence of Work

1. Provide in accordance with Division 01 Section SUMMARY.

B. Outages and Disruptions

1. Continuity of operation of all essential HVAC, plumbing and electrical items, including electrical service, lighting, outlets, power and controls for heating and cooling equipment, auxiliary systems, fire alarm, emergency lighting and power, program, sound, alarms and telephones shall be provided as required for occupancy of the premises during the construction period.
2. Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

    a. Notify Owner no fewer than fourteen days in advance of proposed interruption of electric service.
    b. Indicate method of providing temporary electric service.
    c. Do not proceed with interruption of electric service without Owner's written permission.

3. Provide temporary wiring and connections to maintain existing systems in service during construction.
4. The schedule and timing of any interruption of water, gas or electrical service or disruption of occupied areas that may affect use of the premises by the Owner and the public, shall be coordinated with the Owner and Architect. Temporary or interim use feeders and facilities shall be provided by the Contractor, as approved and/or directed, to minimize the duration and extent of outages or interruptions.
5. In areas where the construction work will interfere unduly with use of the premises, the Owner may direct that construction work be performed during time periods other than indicated above or on Saturdays, Sundays, or Holidays. Judgment as to whether such undue interference may exist shall rest solely with the Owner. Also, the Owner may require that temporary or interim use feeders and facilities shall be provided by the Contractor as approved and/or directed, to minimize the duration and extent of outages or interruptions.
6. Preparatory work shall be performed as completely as possible in each instance prior to scheduled service outages.
7. Contractor shall be responsible for any and all premium time/overtime required to perform outages and cutovers of services. Coordinate with Owner and Architect.
8. Contractor shall be responsible for any and all premium time/overtime required to complete the work in the various areas within the allotted time, as well as any premium/overtime required to install work through unaffected or remote areas from the work as necessary to maintain continuity of services and occupancy of the existing buildings, as required. Coordinate with Owner and Architect.

C. Demolition

1. Notify the Architect at least 5 days prior to commencing demolition operations.
2. Perform demolition in phases as indicated. Refer to Division 01 for additional requirements.
3. Conditions Affecting Demolition: The following project conditions apply:

    a. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
    b. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
    c. Provide nondestructive removal of materials and equipment for reuse or salvage as indicated on drawings.
    d. Provide dismantling of electrical materials and equipment made obsolete by these installations.

4. Examination

    a. Verify field measurements and circuiting arrangements are as shown on Drawings.
    b. Verify that abandoned wiring and equipment serve only abandoned facilities.
    c. Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner's representative before disturbing existing installation.
    d. Beginning of demolition means installer accepts existing conditions.

5. Preparation

    a. When work must be performed on energized equipment or circuits, use qualified personnel.

6. Demolition and Extension of Existing Electrical Work: Demolish and extend existing electrical work as shown on drawings and as described in this section.

    a. Remove, relocate, and extend existing installations to accommodate new construction.
    b. All abandoned wiring shall be disconnected at both ends and removed.
    c. Remove exposed, abandoned conduit, including abandoned conduit above accessible ceilings. Cut conduit flush with walls and floors, and patch surfaces.
    d. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed.
    e. Disconnect and remove abandoned panelboards and distribution equipment.
    f. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
    g. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
    h. All spent fluorescent and HID lamps and ballasts shall be disposed of by the contractor according to NEMA guidelines, the Universal Waste Rule, and the requirements of local and state authorities having jurisdiction. The Universal Waste Rule shall only apply to non TCLP conforming lamps.
    i. Repair adjacent construction and finishes damaged during demolition and extension work, as approved.
    j. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
    k. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
    l. Maintain, restore, and provide electrical service for all receptacles, outlets, lighting fixtures and electrically operated equipment not being demolished. Intercept existing circuit, connect new circuiting into existing circuiting and extend new circuiting back to panelboard or previous “up-stream” device, which is not being removed.
    m. The Contractor shall maintain the operating condition of the existing Fire Alarm System.

7. Disposition of Equipment:

    a. Unless specified, indicated, or directed otherwise, all material and equipment not intended for reuse on this project that is to be dismantled or removed under this contract, shall become Contractor's property and shall be transported from the premises by the contractor.
    b. Exceptions: Contractor shall remove and transport the following items without damage to an on-site location as directed, for inspection and possible salvage by Owner:

        1) Panelboards
        2) Additional Items as the Owner sees fit during demolition

8. Hazardous Materials:

    a. Hazardous materials may be present in building components to be demolished.
    b. Do not disturb hazardous materials or items suspected of containing hazardous materials and immediately notify Owner and Architect.
    c. Hazardous materials will be removed by Owner under separate Contract.

D. New Work

1. Coordinate electrical equipment installation with other building components.
2. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work.
3. Coordinate connection of electrical services with equipment provided under other sections of the specifications.
4. Coordinate requirements for access panels and doors where electrical items requiring access are concealed behind finished surfaces. Verify all dimensions by field measurements.
5. Coordinate the cutting and patching of building components to accommodate installation of electrical equipment and materials.
6. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

E. Cooperation and Coordination with Other Trades

1. This Electrical Contractor must cooperate completely and coordinate work with the contractors of other trades providing equipment under this division and other divisions of the specifications. This is particularly important in connection with Divisions 21, 22, and 23 - Mechanical.
2. Interference drawings shall be prepared as a combined effort of all trades. The Electrical Contractor shall prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations on Mylar backgrounds prepared by the Mechanical Contractor. The Mechanical Contractor shall start their drawings immediately upon award of contract. Drawings shall be at 1/4" = 1'0" scale based on sheet size and plan location and orientation as shown on the architectural drawings. All interference drawings shall be capable of being overlaid to coordinate interferences and for printing. All congested areas and mechanical room plans shall be drawn at 3/8" = 1'0" scale.
3. After the Mechanical Contractor has finished, electronic files will be forwarded to the Plumbing trade who will show and coordinate the plumbing work with the other trades. After the Plumbing trade has finished, electronic files will be forwarded to the Electrical trade who will show and coordinate their work on the combined plans.
4. Interference plans and elevations shall show in detail the location of the following items that require coordination because of size and proximity to other equipment and systems. Drawings shall show in order of installation priority within the allotted space the items prioritized in the following paragraph entitled "Space Priority".

    a. In addition, show electrical work in equipment rooms.
    b. On the interference drawings, show all electrical conduits that are 1-1/2" and larger.
    c. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work.
    d. Proposed locations of major systems, equipment and material.
    e. Work in pipe spaces, chases, and trenches.
    f. Exterior wall penetrations.
    g. Fire-rated wall and floor penetrations.
    h. Ceilings that contain piping, ductwork, or equipment in congested arrangement.
    i. Equipment connections and support details.
    j. Exterior underground lines in common excavation.
    k. Sizes and location of required concrete pads and bases.
    l. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
    m. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
    n. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.
    o. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.

5. Electronic files of the finished interference drawings shall be submitted to the Architect for record before actual installation work begins. Each trade shall make completed interference drawings available to their craft for installation of the work.

6. Individual trade interference drawings may be used as shop drawings and/or as record drawings at the completion of the project.
7. The coordination drawings shall be reviewed and approved by the Owner and Architect, and shall be signed by both the Owner and the Architect.

F. Space Priority

1. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

    a. Gravity flow piping systems
    b. Vent piping systems
    c. Ceiling recessed lighting fixtures
    d. Concealed air terminal units, fans
    e. Air duct systems
    f. Sprinkler systems piping
    g. Forced flow piping systems
    h. Electrical conduit, wiring, control wiring

2. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.
3. Change in order of priority is permissible by mutual agreement of all affected trades.
4. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.
5. The work of a particular trade shall not obstruct access for installation, operation and maintenance of the Work, materials and equipment of another trade.

3.3 SUBSTITUTIONS

A. Provide in accordance with Division 01 Section SUBSTITUTION PROCEDURES and as stated below.

B. Where the contractor proposes substitute equipment, contractor to submit complete product data indicating compliance with all requirements of the documents, including performance rating, size and resistance to wear and deterioration equivalent to the specified item at least ten (10) days prior to the bid date. In instances where substituted equipment requires additional material or work beyond that shown or required by the specified item, said additional material or work shall be the responsibility of this Contractor, regardless of the trade involved.

3.4 SUBMITTALS

A. Provide in accordance with Division 01 Section SUBMITTAL PROCEDURES and as stated below.

B. Submit for approval a complete Material Source of Supply and Subcontractor list for all electrical work required under this project. Shop drawing submittals will not be reviewed until a complete Material Source of Supply and Subcontractor list is received. Submit this listing as a part of the submittal requirement specified in Division 01.

C. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Data submitted from subcontractors and material suppliers directly to the Architect will not be processed.

D. Prepare and submit detailed shop drawings for materials, systems and equipment as listed herein, including locations and sizes of all openings in floor decks, walls and floors.

E. The work described in any shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job. Each submitted shop drawing shall include a certification that all related job conditions have been checked and that no conflict exists.

F. All shop drawings shall be stamped by the Contractor, indicating approval, and space shall be provided for the Engineer's stamp and the Architect's stamp.

G. All drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking and resubmittal as may be required. All submittals shall be complete and contain all required and detailed information.

H. Acceptance of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve the Contractor from responsibility of furnishing all items of proper dimensions, weight, capacities, sizes, quantity and quality as intended by the Contract. Such acceptance shall not relieve Contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.

I. Each shop drawing shall contain job title and reference to the applicable drawing and specification article, including the contractor's drawings, specifications and verification of compatibility with the systems involved.

J. Individual shop drawing submittals shall be provided for each specific material, system or equipment as identified herein. Submittals provided in other than this manner will be return without review.

K. All nameplate data shall be complete at time of equipment submittals - refer to other sections for identification requirements.

L. Equipment shall not be ordered or purchased until the shop drawing approval is received.

M. Shop Drawings shall show conformance with specified electrical characteristics, or Contractor shall assume responsibility for all deviations including all additional costs involved for the deviations.

N. The following is a list of some important material, equipment and systems that require shop drawing approval, refer to each section of this specification for additional submittal requirements:

1. Low Voltage Electrical Power Cables
2. Grounding and Bonding Equipment
3. Hangers and Supports
4. Raceways and Boxes
5. Panelboards
6. Wiring Devices
7. Fuses
8. Enclosed Switches and Circuit Breakers
9. Fire Alarm Devices

O. Product Options:

1. The product manufacturers listed in each section are either the product the design is based on or a product that the Engineer feels would be an acceptable substitution if that product can meet the intent of the written specifications and the scheduled capacities. The Electrical Contractor is responsible for ensuring that the substituted product complies with the intent of the specifications, the scheduled capacities and the drawings. Substitutions of manufacturers not listed are not permitted unless prior approval is obtained from the Engineer as required by Part 3.3, SUBSTITUTIONS, of this specification section.
2. It will be the responsibility of the Electrical Contractor to pay any and all costs associated with any approved substitutions that impact the architectural layout, structure, electrical system(s), mechanical systems, and/or the plumbing systems, due to an increase in physical dimensions, weight, electrical requirements, connection sizes, etc., between the approved substitution item and the equipment item scheduled and/or indicated as the basis of design.

3.5 QUALITY ASSURANCE AND TESTING

A. Provide in accordance with Division 01 Section QUALITY REQUIREMENTS.

B. Provide products that are listed and labeled by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Refer to all Division 26 specification sections for additional testing requirements.

3.6 TEMPORARY

A. Provide in accordance with Division 01 Section TEMPORARY FACILITIES AND CONTROLS and as stated below.

B. Power consumption shall not disrupt Owner's need for continuous service.

C. The Contractor shall provide power outlets for construction operations, branch wiring, and distribution boxes. Each individual contractor will provide flexible power cords as required.

D. Power required for tools and operating equipment used for the installation of equipment, that exceeds the power available, shall be temporarily installed and removed by the Contractor requiring it.

E. Provide wiring and connections for temporary heating equipment required for construction purposes and to prevent building freeze up.

F. The Contractor shall provide temporary lights and all associated wiring as required by the individual prime contractors.

G. Contractor to remove all temporary wiring and temporary lighting.

3.7 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Division 01 Section PRODUCT REQUIREMENTS and as stated below.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for distinct identification; adequately packaged and protected to prevent damage during shipment, storage and handling.

D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

E. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.8 CUTTING AND PATCHING

A. Provide in accordance with Division 01 Section EXECUTION.

3.9 INSTALLATIONS

A. Provide in accordance with Division 01 Section EXECUTION and as stated below.

B. Verify all dimensions by field measurements.

C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

D. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

E. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible.

F. 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.

G. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.

H. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Install access panel or doors where units are concealed behind finished surfaces.

J. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

K. Obtain written approval of locations of all electrical devices from the Owner and Architect prior to rough-in. The owner reserves the right to move any or all electrical devices prior to rough-in, at no additional cost.

L. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

M. Obtain approval from the Architect before drilling or cutting structural members.

N. Holes cut into reinforced concrete beams or in concrete shall not cut reinforcing bars. If the Contractor cuts into any reinforcing bars, stop work and notify the Architect immediately.

O. Refer to equipment specifications in Divisions 02 through 33 for rough-in requirements for equipment furnished under other contracts.

P. Door swings may vary from plans. Make note of actual door swings at time of rough-in. Do not install switches or other items behind the swing of any door.

Q. The installation shall be subject to such revisions as may be necessary to overcome building obstructions.

R. Provide connections to all electrically operated equipment furnished under other sections and/or divisions of this project specification. Verify all power connections with submitted manufacturer's written recommendations prior to installation and prior to energizing circuit.

S. Inspect areas and conditions under which electrical connections for equipment that will be installed and notify the Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

T. Verify that equipment is ready for electrical connection, wiring, and energization.

U. Install all in-line power control, protection, and disconnection devices furnished by others that are not an integral part of the equipment. These devices shall be located in accordance with the Contractor furnishing the devices and the requirements of the NEC.

V. Provide for proper rotation of all three phase motors.

W. Work improperly placed because of Contractor's failure to obtain the above information shall be relocated and reinstalled as directed, without additional costs to the Contract. No charges shall be made in location of equipment without prior written approval.

3.10 FINAL CLEANING

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES.

3.11 WARRANTIES

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES and as stated below.

B. Refer to individual equipment specifications for additional warranty requirements. If a contradiction exists, the most demanding requirements shall prevail.

C. Compile and assemble the warranties specified in Division 26 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

D. Provide complete warranty information for each item to include date of beginning of warranty or bond; duration of warranty or bond; and names, address, and telephone numbers and procedures for filing a claim and obtaining warranty services.

E. Submit a single warranty stating that all portions of the work are in accordance with Contract requirements. Warrant all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. Within 24 hours after notification, correct any deficiencies that occur during the warranty period at no additional cost to Owner, all to the satisfaction of the Owner and Architect. Obtain similar warranties from subcontractors, manufacturers, suppliers and sub-trade specialists.

F. Any material, equipment or appurtenance whose operation or performance does not comply with the requirements of the Contract Documents or that are damaged prior to acceptance will be held as defective and shall be removed and properly replaced at no additional cost to the Owner.

3.12 MAINTENANCE MANUALS

A. Provide in accordance with Division 01 Section OPERATION AND MAINTENANCE DATA and as stated below.

B. Include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Provide a cover sheet for each manual including the project name, Architect’s name and contact information, Engineer’s name and contact information, and Division 26 contractor’s name and contact information.
6. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
7. Manufacturer's data of each piece of equipment including:
    a. Installation instructions.
    b. Drawings and Specifications.

c. Parts list, including recommended items to be stocked.
d. Complete wiring diagrams.
e. Marked or changed prints locating all concealed parts and all variations from the original system design.
f. Test and inspection certificates.

3.13 RECORD DOCUMENTS

A. Provide in accordance with Division 01 Section PROJECT RECORD DOCUMENTS and as stated below.

B. Indicate installed conditions for the following:

1. Raceway systems, size and location, for both exterior and interior.
2. Locations of control devices.
3. Distribution and branch electrical circuitry.
4. Fuse and circuit breaker size and arrangements.
5. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
6. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

3.14 DEMONSTRATION AND TRAINING

A. Provide in accordance with Division 01 Section DEMONSTRATION AND TRAINING and as stated below.

B. After the tests and adjustments have been made, approved factory-authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment installed under this Contract. Dates and times of such instructions shall be as directed by Owner, including any necessary weekend or after-hours instruction.

C. The following is a list system that require Demonstration and Training, refer to the individual specification sections for additional training requirements:

1. Panelboards
2. Enclosed Switches and Circuit Breakers

END OF SECTION 26 0100

SECTION 26 0519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data for electrical wires, cables and connectors.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated, drawn copper current-carrying conductor with an overall insulation layer and jacket, rated 600 V or less.

B. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Cerro Wire
2. Colonial Wire and Cable Company
3. Encore Wire Corporation
4. General Cable Corporation
5. Nehring Electrical Works Company
6. Okonite Company
7. Service Wire Company
8. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN/THWN-2: Comply with UL 83.

2.2 METAL CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems
2. Encore Wire Corporation
3. Okonite Company
4. Service Wire Company
5. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits: Single circuit and multi-circuit with color-coded conductors as required.

E. Conductors for branch circuits, #8AWG and smaller: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors

F. Ground Conductor: Insulated.

G. Conductor Insulation: Type THHN/THWN-2: Comply with UL 83.

H. Armor: Steel, interlocked.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use. Use connectors with temperature ratings equal to or greater than those of the wires upon that are used.

B. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. 3M Electrical Products
2. AFC Cable Systems
3. Burndy
4. Hubbell Power Systems
5. Ideal Industries
6. ILSCO
7. NSi Industries

8. O-Z/Gedney
9. TE Connectivity
10. Thomas and Betts Corporation

C. Jacketed Cable Connectors: For steel jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Match conductor material.
2. Termination: Compression.

2.4 COLOR CODING:

A. Color Coding of Conductors - factory applied the entire length of conductors, provide the following:

1. 208/120V through 240V Conductors:

a. Phase A: Black
b. Phase B: Red
c. Phase C: Blue
d. Neutral: White

2. 480/277V and Above Conductors:

a. Phase A: Brown
b. Phase B: Orange
c. Phase C: Yellow
d. Neutral: Gray

3. Travelers for 3 way/4 way switches shall be purple.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Each length, bundle, or reel of wire and cable delivered to job site shall bear manufacturer's name, catalog number and trademark, UL label, type letters, size, length and manufacturing date.

B. Deliver wire and cable properly packaged in factory fabricated type containers, or wound on NEMA specified type wire and cable reels.

C. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.

D. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

3.2 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.3 CONDUCTOR INSULATION AND MULTI-CONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Branch Circuits:

1. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
2. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway and /or Metal clad cable, Type MC. Provide Type MC Cable only for concealed branch circuit wiring in drywall partitions and above accessible ceilings. MC Cable shall terminate in a junction box above the finished ceiling of space served by circuiting. All homeruns from branch panelboards shall be routed to space served in EMT conduit, unless otherwise specified. MC Cable will not be used as the homerun from space served to panelboard of origin, unless otherwise specified.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Provide wire and cable suitable for temperature, conditions and location; and install in compliance with the NEC.

C. Minimum wire size shall be #12 AWG for all wiring, with the following exceptions:

1. If the distance between the panelboard and the first circuit load is greater than 100 feet, the minimum wire size shall be #10 AWG.
2. All emergency lighting circuit wiring shall be #10 AWG or larger.
3. Conductors and cables for communications and signal systems shall be as described in respective specification sections and as recommended and approved by manufacturer.

D. Provide dedicated neutrals for all single-phase branch circuits.

E. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

F. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

G. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

H. Pull conductors simultaneously where more than one is being installed in same raceway.

I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

J. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

K. MC Cable shall be neatly trained and supported clear of ceiling tile and ceiling grid by means of metallic straps or clips. The use of nylon tie wraps to support MC Cable from the structure is prohibited. Supports for MC Cable shall be independent from supports for other systems (i.e. light fixtures, ceiling grid, and mechanical systems) and the supports for the MC Cable shall be directly connected to the structure.

L. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

M. Conductor/cable supports for vertical runs shall be provided in top cabinet or pull box of all feeders in accordance with NEC requirements.

3.5 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-486B.

B. Splices:

1. Keep conductor splices to minimum.
2. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
3. Splicing of #10 wires and smaller shall be made with Scotchlok or as approved.
4. Splicing of #8 wire and larger shall be made by means of compression type connectors and installed with a proper tool and then insulated to same dielectric value as the original insulation with plastic tape.
5. Splices are not permitted in conductors larger than #10, except where specifically called for.
6. All splicing shall be made in outlet boxes or junction boxes.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Seals for Electrical Systems".

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 26 0544 "Sleeves and Seals for Electrical Systems".

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform each of the following visual and electrical tests:

1. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
2. Test bolted connections for high resistance using one of the following:

    a. A low-resistance ohmmeter.
    b. Calibrated torque wrench.
    c. Thermographic survey.

3. Inspect compression-applied connectors for correct cable match and indentation.
4. Inspect for correct identification.
5. Inspect cable jacket and condition.
6. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
7. Continuity test on each conductor and cable.
8. Uniform resistance of parallel conductors.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product data for connectors and connection materials, and grounding fittings.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Materials: Copper with 98% conductivity.

2.2 MANUFACTURERS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. B-Line Systems Inc.
2. Burndy Corporation
3. Erico International
4. ILSCO
5. O-Z/Gedney
6. Thomas and Betts Corporation

2.3 CONDUCTORS

A. Comply with Division 26 Section 26 0519 " Low Voltage Electrical Power Conductors and Cables"

B. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction, green insulation.

C. Copper Bonding Conductors:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
3. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.4 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. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

C. Bonding Strap: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.5 ACCESSORIES

A. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Equipment Grounding

1. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

a. Branch circuits.
b. Lighting circuits.
c. Receptacle circuits.
d. Single-phase motor and appliance branch circuits.
e. Three-phase motor and appliance branch circuits.
f. Flexible raceway runs.
g. Metal-clad cable runs.

2. Air Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.2 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Terminate insulated equipment grounding conductors with pressure-type grounding lugs.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment. Use braided type bonding jumpers for flexible bonding and grounding connections.

C. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
6. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torqueing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.
7. Provide connections as follows:

a. Equipment Grounding Conductor Terminations: Bolted connectors.

3.3 FIELD QUALITY CONTROL

A. 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.

B. Grounding system will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Structural steel for fabricated supports and restraints.
6. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
7. Fabricated metal equipment support assemblies.

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Manufacturers - subject to compliance with requirements, provide products of one of the following:

a. B-Line/Eaton
b. Caddy/Pentair
c. Flex-Strut, Inc.
d. G-Strut/Gregory Industries, Inc.
e. Haydon Corporation
f. Jet Stream International
g. Madison Electric Products
h. Minerallac Company
i. Power-Strut/Atkore
j. Superstrut/Thomas & Betts
k. Unistrut/Aatkore
l. Westrut/Wesanco

2. Standard: Comply with MFMA-4 factory fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Steel.
4. Channel Width: Selected for applicable load criteria.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Connect with machine bolts to form rigid supports.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Manufacturers - subject to compliance with requirements, provide products of one of the following:
    a. B-Line/Eaton
    b. Empire Industries
    c. Hilti, Inc.
    d. MKT Anchoring Systems
    e. Ramset/ITW
    f. Rawlplug
    g. Red Head/ITW
    h. Simpson Strong-Tie Company

2. Powder Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Mechanical Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
4. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
5. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
6. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M, Grade A325 (Grade A325M).
7. Toggle Bolts: Stainless steel springhead type.
8. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

B. Boxes, Enclosures and Cabinets:

1. Install surface mounted cabinets with minimum of four anchors.
2. In wet and damp location use steel channel supports to stand cabinets one inch off wall.
3. Use sheet metal channel to bridge studs above and below cabinets recessed in hollow partitions.

C. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

D. Use vibration and shock resistant fasteners for attachments to concrete slabs.

E. Provide vibration and shock resistant fasteners for all moving equipment where the energy of the vibration is of sufficient magnitude to produce perceptible vibration or structure transmitted noise in occupied areas. Isolation equipment shall be selected, installed and adjusted in accordance with manufacturer's recommendations. All equipment and material shall be installed so as to operate without objectionable noise or vibration as determined by Architect and Owner. Should such objectionable noise or vibration be produced and transmitted to occupied portions of the building by apparatus, piping or other parts of this work, any necessary changes as approved shall be made by the Contractor.

3.2 SUPPORT INSTALLATION

A. Unless otherwise indicated, fasten all electrical items and their supporting hardware securely to the building structure.

B. Coordinate with the building structural system and other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Raceway Support Methods:

1. In addition to methods described in NECA 1, conduit may be supported by openings through structure members, according to NFPA 70.
2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 pounds, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.
3. Support individual horizontal raceways by separate pipe hangers.
4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
5. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways.
6. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
7. Secure raceways to steel slotted supports with spring nuts using spring friction action for retention in support channel.
8. Spring steel fasteners may be used only for 3/4" raceways above suspended ceilings. For hanger rods with spring steel fasteners, use 1/4 inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
9. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals. Install simultaneously with installation of conductors.

D. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 pounds.

E. Mounting and Anchorage of Surface Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.

7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

F. Install hangers, supports, clamps and attachments to support raceways, boxes, enclosures and cabinets properly from building structure.

G. Install supports with spacings indicated and in compliance with NEC requirements.

H. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

I. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

J. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures.

K. The use of clips or clip-on type supports is not acceptable.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 9113 "Exterior Painting", Section 09 9123 "Interior Painting" and/or Section 099600 "High-Performance Coatings 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 26 0529

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 08 Section “OPENINGS” for Access Doors.

1.2 SUMMARY

A. This Section includes raceways for electrical wiring. Types of raceways in this section include the following:

1. Conduits and fittings
2. Boxes, enclosures, and cabinets
3. Surface raceways
4. Access doors

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product data - submit manufacturer’s data for the following:

a. Conduits and fittings
b. Boxes, enclosures, and cabinets
c. Surface raceways
d. Access doors

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems/Konkore
2. Allied Tube & Conduit
3. Anamet Electrical, Inc.
4. Arlington
5. Bridgeport
6. Calconduit
7. Crouse-Hinds/Eaton
8. Electri-Flex
9. Flexotek
10. KonKore

11. Korkap
12. NEC, Inc.
13. O-Z/Gedney
14. Patriot Aluminum Products
15. Perma-Cote
16. Phoenix
17. Picoma Industries, Inc.
18. Plasti-Bond
19. RACO/Hubbell
20. Republic Conduit
21. Southwire Company
22. Teddico Electrical Products
23. Thomas & Betts/ABB
24. Topaz Electric
25. Western Tube
26. Wheatland Tube

B. Metallic Conduit: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. Electrical Metallic Tubing (EMT): Comply with ANSI C80.3 and UL 797.
2. Flexible Metal Conduit (FMC): Comply with UL 1; zinc-coated steel.
3. Liquid-tight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket and complying with UL 360.
4. Rigid Metal Conduit (RMC): Comply with ANSI C80.1 and UL 6.

C. Metal Fittings: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT: Steel, compression type.
2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Fittings for FMC:

    a. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
    b. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

4. Fittings for LFMC: Cadmium plated, steel fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.
5. Fittings for RMC: Threaded.
6. Joint Compound for RMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 SURFACE RACEWAYS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Hubbell, Inc.
2. MonoSystems, Inc.
3. Panduit Corporation
4. Wiremold/Legrand

B. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

D. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate as required for complete system.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Adalet
2. Appleton Electric/Emerson
3. Cope
4. Crouse-Hinds/Eaton
5. FSR Inc.
6. Hoffman/Pentair
7. Kraloy
8. Milbank Manufacturing
9. OZ/Gedney
10. RACO/Hubbell
11. Spring City Electrical Manufacturing
12. Steel City/Thomas & Betts Company
13. Topaz Electric
14. Wiegmann/Hubbell

B. Device Boxes:

1. Provide size as required by drawings, minimum 2-1/8 inches deep. Boxes shall be one-piece type, gangable boxes are prohibited.
2. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
3. Cast Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
4. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 pounds. Outlet boxes designed for attachment of luminaires weighing more than 50 pounds shall be listed and marked for the maximum allowable weight.
5. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

C. Pull and Junction Boxes:

1. Sheet Metal Pull and Junction Boxes: NEMA OS 1.
2. Cast Metal Pull and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
3. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

D. Accessories:

1. Provide accessories as required for each installation.
2. Provide box supports, mounting ears and brackets, box extension rings, fixture studs, cable clamps and metal straps for supporting boxes that are compatible with boxes being used to fulfill installation requirements for individual wiring situations.
3. Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes to suit respective installation requirements and applications.
4. Provide stainless steel screws and hardware unless noted otherwise.

2.4 ACCESS DOORS

A. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. Babcock-Davis
2. JL Industries, Inc.
3. Karp Associates, Inc.
4. Milcor
5. Nystrom, Inc.

B. General:

1. Provide access door and frame assemblies manufactured as integral units ready for installation.
2. Provide factory fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
3. Refer to Section 08 3113 'Access Doors and Frames' for additional requirements.

C. Materials:

1. Face of door flush with frame, with exposed flange and concealed hinge.
2. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory finished.
3. Frame Material: Same material and thickness as door.
4. Latch and Lock: Cam latch, screwdriver operated
5. Fire Rated Units:

    a. Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
    b. Fire-Resistance Rating: Not less than that of adjacent construction.
    c. Provide with UL label.

PART 3 - EXECUTION

3.1 APPLICATION

A. Raceways:

1. Minimum Raceway Size: 3/4-inch trade size.
2. Indoor Installations: Apply raceway products as specified below unless otherwise indicated:

    a. Exposed: EMT.
    b. Concealed in Ceilings and Interior Walls and Partitions: EMT or MC Cable. Provide Type MC Cable only for concealed branch circuit wiring in drywall partitions and above accessible ceilings. MC Cable shall terminate in a junction box above the finished ceiling of space served by circuiting. All homeruns from branch panelboards shall be routed to space served in EMT conduit, unless otherwise specified. MC Cable will not be used as the homerun from space served to panelboard of origin, unless otherwise specified.
    c. Concealed in masonry walls: PVC.
    d. Final connection to recessed and semi-recessed lighting fixtures, not to exceed 72": FMC.
    e. Damp or Wet Locations: RMC.
    f. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

3. Outdoor Installations - apply raceway products as specified below unless otherwise indicated:

    a. Exposed Conduit: RMC.
    b. Concealed Conduit, Aboveground: RMC.
    c. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

4. Raceway Fittings: Compatible with raceways and suitable for use and location.

    a. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
    b. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
    c. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
    d. Damp or Wet Locations: Watertight fittings.

B. Boxes, Enclosures, and Cabinets

1. Provide boxes, enclosures and cabinets and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements, unless drawings indicate a more stringent requirement:

    a. Interior Dry Locations: Sheet steel, NEMA type 1.
    b. Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R, with threaded hub(s) and gasketed weatherproof cover.

C. Access Doors:

1. Where installed in a fire-rated wall or ceiling, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

3.2 INSTALLATION

A. General:

1. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems".
2. Complete installation of raceways, boxes, enclosures, and cabinets before starting conductor installation.
3. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
4. Support conduit within 12 inches of boxes, enclosures or cabinets to which attached and within 12 inches of change of direction.
5. Do not install aluminum boxes or fittings in contact with concrete or earth.
6. Install raceways square to boxes, enclosures and cabinets and terminate with locknuts. Install locknuts hand tight plus 1/4 turn more.
7. Do not rely on locknuts to penetrate nonconductive coatings on boxes, enclosures and cabinets. Remove coatings in the locknut area prior to assembling conduit to ensure a continuous ground path.
8. Prevent foreign matter from entering raceways, boxes, enclosures and cabinets by using temporary closure protection.
9. Upon completion of installation of raceways, boxes, enclosures and cabinets, inspect interiors and clear all blockages and remove burrs, dirt, and construction debris.

B. Raceways:

1. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed.
2. Make bends in raceway using either large-radius preformed elbows or field bending. Use only equipment specifically designed for material and size involved. Make bends and offsets so the inside diameter is not effectively reduced.
3. Run parallel raceways together.
4. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
5. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 pound tensile strength. Leave at least 12 inches of slack at each end of pull wire.
6. Do not run raceways exposed on floors.
7. Do not run raceways exposed on roofs.
8. Where raceways terminate at locations subject to moisture, provide insulating bushings to protect conductors.
9. Where terminations are subject to vibration, use bonding bushings or wedges to ensure electrical continuity.
10. Indoor Raceways:

    a. Conceal conduit within finished walls, ceilings, and floors except in equipment rooms and attics/crawl spaces, unless otherwise indicated.
    b. Do not fasten conduits onto the bottom side of a metal deck roof.
    c. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
    d. Install conduits parallel or perpendicular to building lines.
    e. Where a ceiling is scheduled to be exposed to structure, all conduit shall be secure to structure to provide a clean, organized appearance. Where routed between structural elements, install conduit as high as practical.
    f. Where conduit is installed concealed in masonry walls, transition PVC conduit within masonry wall to otherwise-specified interior or exterior raceway.
    g. Terminations:

        1) Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box.
        2) Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
        3) Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder.
        4) Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

    h. Stub-Ups to Above Recessed Ceilings:

        1) Use EMT for raceways.
        2) Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

    i. Expansion Joint Fittings:

        1) Install in each run of EMT conduit that is located where environmental temperature change may exceed 100°F and that has straight-run length that exceeds 100 feet.
        2) Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

            a) Indoor Spaces Connected with Outdoors without Physical Separation: 125°F temperature change.
            b) Attics: 135°F temperature change.

3) Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree F of temperature change for metal conduits.
4) Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5) Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

11. Raceway Sealants:

a. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
b. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1) Where an underground service raceway enters a building or structure.
2) Conduit extending from interior to exterior of building.
3) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
4) Where otherwise required by NFPA 70.

12. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

C. Boxes, Enclosures and Cabinets:

1. Locations shown on Contract Drawings are approximate unless dimensioned.
2. Mount at heights indicated on Drawings. If mounting heights are not individually indicated, give priority to ADA requirements. Install with height measured to top of box unless otherwise indicated.
3. Provide support of junction and pull boxes from building structure. Do not support boxes by conduits.
4. Position recessed boxes, enclosures and cabinets to allow for surface finish thickness.
5. Mount boxes, enclosures and cabinets with fronts straight and plumb.
6. Install surface-mounted cabinets with minimum of four anchors.
7. Locate and install to allow access. Where installation is otherwise inaccessible, coordinate locations and sizes and provide required access doors.
8. Coordinate masonry cutting to achieve neat openings.
9. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
10. Locate so that cover or plate will not span different building finishes.
11. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation. Provide minimum 24 inch separation in acoustic-rated walls.
12. Coordinate mounting heights and locations of wall outlets mounted where counters, benches, and backsplashes are to be installed. Install outlets 6" above tops of counters and benches.
13. Coordinate mounting heights and locations of wall outlets where wall-mounted heating units are to be installed.
14. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
15. Mount outlet boxes for switches and receptacles with the long axis vertical unless noted otherwise. Three or more gang boxes shall be mounted with the long axis horizontal.
16. Electrically ground metallic boxes, enclosures and cabinets.
17. Where wiring to an item that includes a grounding conductor, provide a grounding terminal in the interior of the box, enclosure or cabinet.
18. Existing Outlet Boxes: Where extension rings are required to be installed, drill new mounting holes in the rings to align with the mounting holes on the existing boxes where existing holes are not aligned.

D. Surface Raceways:

1. Install surface raceways only where indicated on Drawings.
2. Install surface raceway with a minimum 2-inch radius control at bend points.
3. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

E. Installation of Access Doors:

1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
2. Adjust hardware and panels after installation for proper operation.

F. Sleeve and Sleeve Seal Installation for Electrical Penetrations:

1. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Seals for Electrical Systems".
2. Install firestopping at penetrations of fire rated floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Seals for Electrical Systems".

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to painted finishes using matching corrosion inhibiting touch-up coating recommended by the manufacturer.

END OF SECTION 26 0533

SECTION 26 0544 - SLEEVES AND SEALS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors
2. Sleeve seal systems and fittings
3. Grout
4. Sealants
5. Firestopping

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Product data for the following products:

a. Sealants
b. Firestopping

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 minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw fastening the sleeve to the board.

2.2 SLEEVE SEAL SYSTEMS AND FITTINGS

A. Description: Provide modular mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates that cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

B. Material:

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

C. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Advance Products and Systems Inc.
2. Calpico
3. GPT Industries
4. MetraFlex

2.3 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Color: As selected by the Architect from manufacturer's standard colors.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

C. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. 3M
2. Adfast
3. Dow Corning Corporation
4. GE Construction Sealants
5. Pecora Corporation
6. Rectorseal
7. Sika Corporation
8. Soudal USA
9. Tremco, Inc.

2.5 FIRESTOPPING

A. General:

1. Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

2. Equipment used shall be in accordance with the firestop manufacturer's written installation instructions.
3. Color: Red.

B. Performance Requirements

1. Fire Test Response Characteristics:

a. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
b. Test per testing standards referenced in "Penetration Firestopping Systems" article. Provide rated systems complying with the following requirements:
c. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) FM Global in its "Building Materials Approval Guide."

C. Penetration Firestopping Systems

1. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
2. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

a. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

3. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

a. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
b. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
c. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

4. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

a. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

5. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
6. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

a. Permanent forming/damming/backing materials.
b. Substrate primers.
c. Collars.
d. Steel sleeves.

D. Fill Materials

1. Cast-in-Place Firestop Devices: Factory assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

2. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
3. Firestop Devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
4. Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced intumescent elastomeric sheet bonded to galvanized steel sheet.
5. Intumescent Putties: Non-hardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
6. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
7. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
8. Pillows/Bags: Reusable heat expanding pillows/bags consisting of glass fiber cloth cases filled with a combination of mineral fiber, water insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel reinforcing wire mesh to protect pillows/bags from being easily removed.
9. Silicone Foams: Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
10. Silicone Sealants: Single-component, silicone based, neutral curing elastomeric sealants.

E. Mixing

1. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

F. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. 3M
2. A/D Fire Protection Systems
3. Emerson/Nelson
4. Hilti
5. Nuco Inc.
6. PFP Partners
7. RectorSeal
8. Specified Technologies Inc.
9. Tremco, Inc.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall provide sleeves where raceways pass through walls, floors, and ceilings.

B. Where piping or raceways pass through waterproofed floors or walls, design of sleeves shall be such that waterproofing can be flashed into and around the sleeves.

C. Where items pass through roofs, coordinate the installation with the roofing installer and provide an approved penetration to maintain the roof warranty.

3.2 SLEEVE INSTALLATION

A. Sleeves for Conduits Penetrating Above-Grade Concrete and Masonry Unit Floors and Walls:

1. Interior Penetrations of Walls and Floors:

   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall/floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during construction of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
4. Install sleeves for floor penetrations. Extend sleeves installed in floors 6 inches above finished floor level. Install sleeves during construction of floors.

B. Sleeves for Conduits Penetrating Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

C. Roof Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

D. Aboveground, Exterior Wall Penetrations: Seal penetrations using stainless steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Underground, Exterior Wall and Floor Penetrations: Install cast iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.3 SLEEVE SEAL SYSTEMS AND FITTINGS INSTALLATION

A. Provide sleeve seal system for below-grade sleeves through exterior walls.

B. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

C. Install sleeve-seal fittings in new walls and slabs as they are constructed.

D. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates in accordance with manufacturer's recommended values to ensure that sealing grommets expand to make watertight seal.

E. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

F. Secure nailing flanges to concrete forms.

G. Using grout, seal the space around outside of sleeve seal fittings.

3.4 SEALANTS

A. General:

1. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
2. Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Preparation:

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

    a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
    b. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
    c. Remove laitance and form-release agents from concrete.
    d. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

2. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
3. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.5 FIRESTOPPING

A. General:

1. Where conduits, conduit sleeves, wireways and other electrical raceways or cables pass through fire partitions, fire walls, fire floors, or smoke walls, provide a fire or smoke stopping that provides an effective barrier against the spread of fire, smoke or gases.
2. Provide firestopping with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs.
3. Install materials in accordance with printed instructions of the UL Fire Resistance Directory and per manufacturer's published instructions.
4. All cables that are installed in conduit sleeves or in wireways through fire or smoke floors or partitions shall be provided with an equally rated re-enterable UL listed fire and smoke rated silicone RTV foam in the opening.
5. Keep areas of work accessible until inspection by applicable code authorities.

B. Preparation:

1. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

    a. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
    b. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
    c. Remove laitance and form-release agents from concrete.

C. Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

D. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

E. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

F. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

G. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 26 0544

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Cable/Conductor Identification Bands
2. Laminated Acrylic or Melamine Plastic Labels
3. Self-Adhesive Labels

1.3 SUBMITTALS

A. Product Data for each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION PRODUCTS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Brady Corporation
2. Champion America
3. Emedco
4. Grafoplast
5. Hellerman Tyton
6. Ideal Industries
7. LEM Products, Inc.
8. Marketing Services, Inc.
9. Panduit

B. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and

operation/maintenance of the electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

C. Cable/Conductor Identification Bands: Provide manufacturer's standard aluminum wrap-around cable/conductor markers, of size required for proper application with stamped or embossed legend, and numbered to show circuit identification.

D. Laminated Acrylic or Melamine Plastic Labels:

1. Engraved with black letters on white face, unless noted otherwise.
2. Thickness:

a. For signs up to 20 sq. in. minimum 1/16 inch thick.
b. For signs larger than 20 sq. inch, 1/8 inch thick.

3. Fasteners for Laminated Acrylic or Melamine Plastic Labels:

a. Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers. Where screws cannot or should not penetrate substrate, provide contact type permanent adhesive.

E. Self-Adhesive Labels:

1. Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Install identifying devices before installing acoustical ceilings and similar concealment.

B. Verify identity of each item before installing identification products.

C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

3.2 APPLICATION AND INSTALLATION

A. Accessible Fittings for Raceways: Using permanent marker, identify the covers of each junction and pull box with the panelboard and circuit number(s) of installed conductors.

B. Receptacle Faceplates: Using self-adhesive labels applied to face of plate, identify panelboard and circuit number feeding device. Label shall be clear with black lettering.

C. Cable/Conductor Identification Bands: Apply cable/conductor identification bands indicating circuit number on each cable/conductor in each panelboard.

D. Contactors: Using permanent marker, identify controlled circuits in contactors.

E. Labels

1. General:

a. Attach labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
b. Before applying self-adhesive electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
c. Apply labels to exterior of door or cover. In finished areas, install labels to inside face of doors.
d. Provide labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
e. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on minimum 1-1/2 inch high sign; where two lines of text are required, use signs minimum 2 inches high.

2. Equipment Identification Labels: Provide laminated acrylic or melamine plastic equipment identification labels for each device in the following categories of electrical equipment. Text shall match terminology and numbering of the Contract Documents and shop drawings.

a. Contactors.
b. Disconnect switches
c. Panelboards

END OF SECTION 26 0553

SECTION 26 0573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY (alternate bid)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes provisions for electrical distribution coordination, short circuit analysis, and shock and flash hazard studies.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Eight bound copies or coordination, short circuit, and shock and flash hazard studies.
2. Electronic copy of studies on CD (8 copies).
3. All flash hazard labels for use on equipment associated with the study (3 copies).
4. Complete SKM database for study on CD for future Owner use (2 copies).

1.4 QUALITY ASSURANCE

A. Qualifications: Firm engaged in performing studies of this type for at least 5 years.

1.5 SEQUENCE AND SCHEDULING

A. Contractor shall submit three (3) copies of preliminary coordination and short circuit study prior to submitting distribution equipment submittals. No submittals for switchgear, switchboards, panelboards, transformers, etc., will be approved without prior submittal of coordination and short circuit study.

B. If preliminary study indicates issues with equipment that will be submitted, preliminary study shall be rerun using alternate equipment with ratings and settings appropriate for the system being installed.

C. After approval of preliminary coordination study, contractor shall submit distribution equipment submittals for approval, including any necessary revisions indicated by preliminary coordination and short circuit study.

D. Provide final bound coordination, short circuit, and shock and flash hazard study. Provide PPE labels for all equipment being provided, and for existing equipment included in study. Provide CD with each copy of study containing all study files and input files.

PART 2 - PRODUCTS

2.1 STUDIES

A. Provide, in accordance with industry standards, the electrical studies listed in this section.

B. All studies shall incorporate the actual equipment being provided, and actual cable lengths, conduit types, and wire sizes of feeders being installed. Provide all field survey work necessary to obtain all required information from existing equipment that will be connected to as part of this project, in order to include existing equipment in study. This includes, but is not limited to, nameplate information, catalog numbers, trip unit settings, and relay settings.

C. All studies shall be performed using analysis software as manufactured by SKM Systems Analysis, Inc.

2.2 ELECTRICAL DISTRIBUTION COORDINATION STUDY

A. Provide a complete electrical distribution coordination study, based on the equipment being submitted. Submit complete documentation of the coordination of all circuit breakers and fused switches. The study shall provide recommendations for the settings of all adjustable devices (i.e. ground fault, adjustable breakers) to provide maximum coordination and selectivity. This report shall include a composite drawing for each segment of the distribution system showing the time-current curves of all devices, with the devices set as recommended. This shall include the complete characteristic curves for all circuit protection devices.

2.3 SHORT CIRCUIT ANALYSIS

A. Provide a complete short circuit analysis, based on the actual equipment and conductor lengths provided by the Contractor. Analysis shall include all new equipment on project, and any and all existing equipment to which new equipment or feeders are being connected to.

2.4 EQUIPMENT EVALUATION ANALYSIS

A. Provide a complete equipment evaluation analysis, based on the actual equipment and conductor lengths provided by the Contractor. Analysis shall include all new equipment on project, and any and all existing equipment to which new equipment or feeders are being connected to. Provide a list of any equipment that is not rated for the available fault current at its location.

2.5 COORINATION STUDY

A. Provide a complete coordination study, based on the actual equipment provided by the Contractor. Coordination study shall include all relays, adjustable trip circuit breakers, fuses, and all thermal magnetic breakers in distribution equipment down to and including enclosed circuit breakers, and branch circuit breakers in panelboards.

B. Adjust settings and fuses to obtain the highest level of coordination while maintaining a PPE level of 2 or less at each piece of equipment. Where level 2 PPE cannot be attained, settings shall be adjusted to obtain the lowest arc flash energy level possible.

C. Provide color TCC curve plots for all equipment in coordination study. TCC's shall include device names and setting for each device on the TCC plot.

D. Provide a list of recommended settings for use by the Contractor in programming and setting all breakers and fuses.

2.6 SHOCK HAZARD AND FLASH HAZARD ANALYSIS

A. Provide a complete shock hazard and flash hazard analysis, based on the actual equipment and conductor lengths provided by the Contractor. Provide for all warning signs and classification signage on all distribution equipment as required by NFPA 70E, 2009 Edition.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide for adjustment and setting of all trip units and relays according to coordination study recommendations.

B. Install all PPE labels on equipment.

END OF SECTION 26 0573

SECTION 26 2416 - PANELBOARDS (alternate bid)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.
2. Existing panelboard interior replacement.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. ICS: Industrial Control Systems

E. MCOV: Maximum continuous operating voltage.

F. RFI: Radio frequency interference.

1.4 SUBMITTALS

A. Product Data - for each type of panelboard, overcurrent protective device, accessory, and component indicated, include:

1. Dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings - for each panelboard, include:

1. Dimensioned plans, elevations, sections, and details.
2. Enclosure types and details for types other than NEMA 250, Type 1.
3. Bus configuration, and current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.

C. Maintenance Manuals - in addition to requirements specified in Division 01 and 26, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

D. Overcurrent Protective Device Coordination Study: Provide in accordance with Section 26 0573.

E. Layout Drawings: Prepare layout drawing for each room or area of the building containing panelboards and submit for review at the time of the equipment submittal. Layout drawings shall be based on actual submitted equipment dimensions. Indicate working clearances for each panelboard.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E. Firm with at least 5 years of successful installation experience on projects utilizing panelboards similar to those required for this project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver panelboard interiors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Remove loose packing and flammable materials from inside panelboards.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Keys: Furnish six spares of each type for panelboard cabinet locks.

B. Touch-up Paint: For surface mounted panelboards - one half-pint container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - subject to compliance with requirements, provide panelboards of the following manufacturer:

1. Eaton
2. GE by ABB
3. Schneider Electric/Square D
4. Siemens Industry, Inc.

2.2 GENERAL

A. Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Refer to Panelboard Schedules on drawings for additional panelboard requirements, including but not limited to, mains type and size, mounting, branch circuit breaker sizes and quantities, SCCR rating, options, etc.

C. Enclosures:

1. Provide flush and surface mounted enclosures as indicated on the drawings.
2. Standard panel dimensions: 6” deep x 20” wide x 84” high (maximum height).
3. Rated for environmental conditions at installed locations:

    a. Indoor Dry Locations: Steel, Type 1

4. Back box Finish:

    a. Flush-mounted cabinets: Galvanized steel.

D. Incoming Mains:

1. Main breaker or main lugs as indicated on drawings.
2. Location shall be convertible between top and bottom.
3. Main lug interiors shall be field convertible to main breaker.

E. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

    a. Plating shall run entire length of bus.
    b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. All bus work shall be rated to withstand short circuit stresses at specified voltage as described on the panelboard schedules shown on the drawings.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
5. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75°C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs (where indicated on drawings): Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

G. Panelboard Short-Circuit Current (SCCR) Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Panelboards with a Series Short Circuit Rating are not acceptable.
2. Assembly shall be UL listed for 100 percent interrupting capacity.
3. Minimum short circuit current rating of panelboard shall be as specified on the panelboard schedules shown on the drawings. No device within panelboard shall be lower than this rating.

H. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

2.3 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

A. NEMA PB 1, lighting and appliance branch-circuit type.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Doors/Covers:

1. Hinged Front Cover: Door-in-door construction with concealed hinges. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.EZ Trim as manufactured by Eaton is not acceptable.
2. Secured with flush latch with tumbler lock; keyed alike.
    a. For doors more than 36 inches high, provide two latches, keyed alike.
3. Finish:
    a. Indoor Dry Locations: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

2.4 EXISTING PANELBOARD INTERIOR REPLACEMENT

A. Where replacement of existing panelboard interior (phase, neutral, and ground buses and main breaker/main lugs) and trim is indicated, the Contractor shall remove the existing panel interior and cover and replace with new as follows:

1. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
2. Doors/Covers:
    a. Hinged Front Cover: Door-in-door construction with concealed hinges. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.
    b. Secured with flush latch with tumbler lock; keyed alike.
        1) For doors more than 36 inches high, provide two latches, keyed alike.

c. Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
d. The new door/cover shall be sized to accommodate the existing panelboard backbox and may need to be oversized in order to overlap the adjacent masonry surface.

B. Contractor shall verify exact dimensions of existing panelboard backbox and confirm that new interior can be installed in existing backbox. Notify Engineer of any potential issues prior to ordering panelboard interior.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breaker (MCCB) with interrupting capacity to meet available fault currents.

1. General

a. Circuit breakers shall have quick-make, quick-break operating mechanisms and silver alloy contacts.
b. The operating handle shall indicate ON, TRIPPED, and OFF positions.
c. Multi-pole units enclosed in a factory assembled to operate as a single unit.
d. Circuit breakers shall be electrically and mechanically trip free.
e. Circuit breakers shall be UL489 listed.
f. Circuit breakers and terminals shall have a UL 60/75°C rating.
g. UL listed for reverse connection without restrictive line or load ratings.
h. Tandem circuit breakers shall not be used.
i. Mechanical style lugs, suitable for number, size, trip ratings, and material of conductors.
j. Three-pole breakers with ampere ratings greater than 250 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
k. Unless indicated otherwise, circuit breakers 800A frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.

2. Thermal Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable Trip Circuit Breakers:

1) Provide adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2) Field-adjustable trip settings for magnetic trip element shall be front-mounted.

3. Molded Case Circuit Breaker Options and Accessories:

a. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position for circuit(s) feeding fire alarm control and extender panel(s).
b. Subfeed Circuit Breakers: Vertically mounted.
c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
d. GFCI Circuit Breakers: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

2.6 PANELBOARD OPTIONS

A. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.7 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated circuit directory card inside panelboard door, mounted in metal frame with transparent protective cover. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Existing Panelboard Circuit Directory: Where circuiting in existing panelboards has been revised (added and/or eliminated), provide an updated, computer-generated circuit directory card inside panelboard door, mounted in metal frame with transparent protective cover. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits. Circuit directory shall incorporate existing loads and new loads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Mounting:

1. Panelboards shall be installed such that the center of the grip of the operating handle of any overcurrent devices (switch or circuit breaker) located in the panelboard, when in its highest position, is not more than 6'-7" above finished floor or working platform.
2. Mount panelboard cabinet plumb and rigid without distortion of box.
3. Mount panelboards with minimum of four anchors.
4. Mount surface-mounted panelboards to steel slotted supports 1-5/8 inch in depth. Orient steel slotted supports vertically.
5. Mount flush-mounted panelboards with fronts uniformly flush with wall finish and mating with back box.
6. Install flush-mounted panelboards with an overlapping trim set tight to the wall surface.
7. Use sheet metal channel to bridge studs above and below panelboards recessed in hollow partitions.

C. Maintain required workspace clearances per NEC 110.26.

D. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

E. Make grounding connections and bond neutral for services and separately derived systems to ground.

F. Install filler plates in unused spaces.

G. Wiring in Panel Gutters: Arrange conductors neatly in groups and bundle and wrap with wire ties after completion of load balancing.

H. Install Handle Clamp(s) on circuit breaker(s) feeding fire alarm control and extender panel(s).

I. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

J. Where replacement of existing panelboard interior and cover is indicated, the Contractor shall:

1. Install new panelboard interior in existing backbox.
2. Install factory door/cover on existing backbox.
3. Reconnect existing feeder wiring and all existing load branch circuit wiring, unless noted otherwise.
4. Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

3.3 IDENTIFICATION

A. Identify field installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section 26 0553 "Identification for Electrical Systems."

B. Panelboard Directory:

1. Create a directory to indicate installed circuit loads.
2. All panelboard directories shall reflect the as built electrical configuration of the job, including the approved changes required to balance the panel loads.
3. Each directory entry shall include a description of the connected load(s) and the room number, which corresponds to the location(s) of the connected loads.
4. Incorporate Owner's final room designations.
5. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
6. Obtain approval before installing.
7. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate in accordance with Nameplate Detail - Panelboards shown on the drawings.

3.4 FIELD QUALITY CONTROL

A. Inspect for defects and physical damage.

B. Check panelboard mounting, area clearances, and fit of components.

C. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

D. Test continuity of each circuit.

E. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

F. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

G. For circuit breakers 200 amps and larger, perform each visual inspection, mechanical inspection, and electrical test indicated in NETA ATS, Section 7.6. Engage a qualified independent testing agency to perform specified testing and certify compliance with test parameters.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
5. Make changes to color-coded phase wires as required to reflect installed condition.

3.6 CLEANING

A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 2416

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems that are intended to carry, but not utilize, electric energy.

B. This Section includes the following:

1. Receptacles:

    a. Standard receptacles
    b. GFCI receptacles
    c. Weather-resistant GFCI receptacles

2. Toggle switches
3. Wiring device accessories

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

1.4 SUBMITTALS

A. Product data: Submit manufacturer's data for each type of product specified.

PART 2 - PRODUCTS

2.1 GENERAL WIRING DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with the following:

1. NEMA WD 1 and WD 6.
2. NFPA 70.
3. RoHS.
4. UL 498.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with requirements in this Section.

D. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
2. Devices installed in surface raceways shall match the raceway color.
3. The Contractor shall verify color selections with the Architect and Owner prior to ordering any devices.

F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 RECEPTACLES

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Eaton Wiring Devices/Arrow Hart
2. Hubbell
3. Legrand/Pass & Seymour
4. Leviton

B. Standard Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

C. Ground Fault Current Interrupter (GFCI) Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

2. Provide GFCI-type device. Device shall include indicator light that is lighted when device is tripped. Device shall conduct an automatic test every three seconds, ensuring ground fault protection. If protection is lost, power to the unit is disconnected and indicator light flashes indicating that the unit should be replaced. Device shall be designed for installation in a 2-3/4 inch deep outlet box without an adapter.

D. Weather Resistant GFCI Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.
2. Listed and labeled as complying with NFPA 70 "Receptacles in Damp or Wet Locations" article.
3. Provide GFCI-type device. Device shall include indicator light that is lighted when device is tripped. Device shall conduct an automatic test every three seconds, ensuring ground fault protection. If protection is lost, power to the unit is disconnected and indicator light flashes indicating that the unit should be replaced. Device shall be designed for installation in a 2-3/4 inch deep outlet box without an adapter.
4. Receptacle shall have internal locking shutter mechanism that opens when the two receptacle blade slots are penetrated simultaneously or receptacle requires the presence of an object in both right and left contacts to energize the device. Receptacle shall be listed to UL and federal specification WC596-F.

2.3 TOGGLE SWITCHES

A. Manufacturers - subject to compliance with requirements, provide wiring devices of one of the following (for each type and rating of wiring device):

1. Hubbell Inc.
2. Cooper Wiring Devices
3. Pass & Seymour
4. Leviton

B. General: Provide specification grade, heavy duty, 120V/277V, 20A, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and having wrap around bridge for installation strength.

2.4 WIRING DEVICE ACCESSORIES

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Eaton Wiring Devices/Arrow Hart
2. Hubbell
3. Legrand/Pass & Seymour
4. Leviton

B. Wall plates for use in interior, dry locations: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide .04 inch thick, Type 302 brushed stainless steel flush cover plates.

C. Wall plates for use in interior, dry locations with surface-mounted devices in unfinished areas: Raised galvanized steel with rounded corners.

D. Wall plates for use in damp or wet locations:

1. Weatherproof, extra-duty, while-in-use type with gasketed, clear polycarbonate cover and lockable tab.
2. Weatherproof gasketed die-cast aluminum cover.

E. Blank cover plates shall match adjacent device plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Protection

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
3. Protect installed components from damage.
4. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

E. Device Installation:

1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
2. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
3. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
4. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
5. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
6. Tighten unused terminal screws on the device.
7. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
8. Unless otherwise indicated, mount flush, with long dimension vertical.
9. Install receptacles vertically, with ground pin located at the top. Where horizontal mounting is required due to space constraints, install receptacle with neutral blade located at the top.
10. Group adjacent devices under single, multi-gang wall plates.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Diagnostic testing: Use a digital wiring analyzer with digital readout or illuminated LED indicators of measurement complying with UL 1436. Perform the followings diagnostic tests, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems.

    a. Line Voltage: Acceptable range is 105 to 132 V.
    b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
    c. Ground Impedance: Values of up to 2 ohms are acceptable.
    d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

2. Using the test plug, verify that the device and its outlet box are securely mounted.

B. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes cartridge fuses, rated 600 V and less, for use in switches.

1. Class RK1 Time Delay Fuses

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Product data - include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current limiting characteristics.
3. Time current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

C. Ambient Temperature Adjustment Information. If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses adjusted.

1. For each adjusted fuse, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

D. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide fuses from a single manufacturer.

B. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

C. ANSI Compliance: Comply with applicable requirements of ANSI C97 "Low Voltage Cartridge Fuses 600 Volts or Less".

D. UL Listing and Labeling: Items provided under this Section shall be listed and labeled by UL.

E. Comply with NEMA FU 1.

F. Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this Section shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver spare fuses stored in locked spare fuse cabinet after cabinet has been installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - subject to compliance with requirements, provide products by the following:

1. Bussmann Division, Cooper Industries, Inc.
2. Shawmut Division; Gould Inc.
3. Littlefuse, Inc.

2.2 FUSES - GENERAL

A. General: Provide fuses of types, classes, and current ratings as indicated. Voltage ratings shall be consistent with the circuits on which used.

2.3 CARTRIDGE FUSES

A. General: Comply with ANSI/IEEE Standard FU1, "Low Voltage Cartridge Fuses." Provide nonrenewable cartridge type fuses.

1. Fuses shall be all of the same manufacturer.
2. Class RK1 Dual Element Time Delay Fuses: Comply with UL 198E, "Class R Fuses."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION OF FUSES

A. Fusible Switches - apply the following class and types:

1. 30-600 Amperes: Class RK1, time delay.

B. Combination Starters: Class RK1, time delay.

3.3 INSTALLATION

A. Provide fuses in all fuse gaps of all equipment provided under this Contract.

B. Install fuse so that ratings are readable without removing fuse.

C. Fuses shall not be installed until equipment is ready to be energized.

D. Install spare fuse cabinet wall mounted where indicated.

3.4 FIELD QUALITY CONTROL

A. Prior to energization of fusible devices, test devices for continuity of circuitry and for short-circuits. Replace malfunctioning units with new units, and then demonstrate compliance with requirements.

3.5 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fusible device.

END OF SECTION 26 2813

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes circuit and motor disconnects.

B. Extent of circuit and motor disconnect switch work is indicated by drawings and schedules.

C. Types of circuit and motor disconnect switches in this section include the following:

1. Equipment disconnects
2. Motor circuit disconnects
3. Contactors

D. Wires/cables, raceways, and electrical boxes and fittings required in connection with circuit and motor disconnect work are specified in other Division 26 sections.

1.3 SUBMITTALS

A. Product Data: For each type of switch, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Maintenance data for circuit and motor disconnects, for inclusion in Operation and Maintenance Manual specified in Division 01 and Division 26 Section 26 0100 “Basic Electrical Requirements”.

C. Shop Drawings: Submit shop drawings of electrical circuit and motor disconnect switches showing accurately scaled switches, their layouts, and proximity to associated equipment.

D. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short circuit current rating.
4. UL listing for series rating of installed devices.
5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

E. Maintenance Data: For enclosed switches and components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:

1. Routine maintenance requirements for components.
2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of circuit and motor disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing circuit and motor disconnect work similar to that required for this project.

C. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.

D. UL Compliance: Comply with requirements of UL98, "Enclosed and Dead Front Switches". Provide circuit and motor disconnect switches that have been UL listed and labeled.

E. UL Compliance: Comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials that are UL-listed and labeled.

F. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000 volts maximum).

G. Product Selection for Restricted Space: Drawings indicate the location where enclosed switches are to be installed. Verify the suitability for installation in this location, including clearances between enclosures, and adjacent surfaces and other items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide circuit and motor disconnects of one of the following:

1. Square D Company
2. Eaton Corporation
3. General Electric Company
4. Siemens
5. ASCO (Contactors only)

2.2 FABRICATED SWITCHES

A. Heavy Duty Safety Switches:

1. Provide surface mounted, heavy duty type, sheet steel enclosed safety switches of types, sizes and electrical characteristics indicated on the drawings.
2. Provide switches with quick-make, quick-break type operation, with switchblades that are visible in the 'OFF' position with door open.
3. Operating handle shall be an integral part of the enclosure base the operating position shall be easily recognizable and pad-lockable in OFF position.
4. Current carrying parts shall be constructed of 98% conductivity copper, with silver-tungsten type switch contacts and positive pressure type reinforced fuse clips.
5. Provide disconnect switches having the capability to have auxiliary contacts mounted as required.

B. Fusible Switches: Heavy duty safety switches as described above, with positive pressure type reinforced fuse clips and fuses of classes and current ratings indicated. See Division 26 Section 26 2813 “Fuses” for specifications. Where

current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.

C. Manual motor starters:

1. Toggle type manual motor starter having low voltage protection, surface mounted in a NEMA 1 enclosure, Square D Class 2510 where indicated on the drawings.
2. Where motor switches are located remote or out of sight from equipment controlled, switch shall be provided with an approved neon pilot light.
3. Provide motor and motor starter disconnects with horsepower ratings suitable to the loads.

D. Contactors

1. Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.

a. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
b. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
c. Enclosure: Comply with NEMA 250.

E. Enclosures shall meet environmental conditions of installed location.

1. Indoor Locations: NEMA 250, Type 1
2. Outdoor Locations: NEMA 250, Type 3R.

F. Finish shall be manufacturer's standard gray finish unless otherwise noted on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECTS

A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and NECA's "Standard of Installation" and in accordance with recognized industry practices.

C. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

D. Install disconnect switches for use with motor driven appliances, and motors and controllers within sight of the controller position unless otherwise indicated.

E. Coordinate layout and installation of switches and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

F. Install power wiring. Install wiring between switches and control, and indication devices.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Where the motor is located out of sight or more than 50 feet from its circuit breaker (or combination starter) this Contractor shall provide a properly rated motor circuit switch at the motor location in accordance with the CIRCUIT AND MOTOR DISCONNECT section of this Specification.

1. Exceptions:

a. Where equipment is furnished complete with an approved integral disconnect.

3.2 NEUTRAL BAR

A. When a neutral conductor is required for the load connected to a safety switch, the Contractor shall provide a copper neutral bar in the safety switch. This copper neutral bar shall be furnished by the manufacturer of the disconnect switch and shall be designed to be installed within the particular disconnect switch installed.

3.3 GROUNDING

A. Install equipment grounding connections for switches with ground continuity to main electrical ground bus.

B. Provide an equipment grounding kit with all disconnect switches.

C. Connections shall be tightened in accordance with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing Agency: The Contractor shall perform the following testing or engage a qualified independent testing agency to perform testing.

C. Testing: After installing enclosed switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches 200 amps and larger. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. Upon completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 2816

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Emergency lighting units.

1.3 DEFINITIONS

A. Fixture: See "Luminaire."

B. LED: Light-emitting diode.

C. Lumen: Measured output of lamp and luminaire, or both.

D. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of fixture designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of fixtures.
4. Include installation and attachment details.
5. Include emergency lighting units, including batteries and chargers.
6. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver lighting fixtures and accessories in factory fabricated containers or wrappings that properly protect fixtures from debris and physical damage.

B. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

C. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

1.6 WARRANTY

A. Manufacturer and Installer agree to repair or replace components of fixtures that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Manufacturers

1. Provide lighting fixtures of types described on the drawings under the 'LIGHTING FIXTURE SCHEDULE'.
2. Provide lighting fixtures complete with, but not limited to, housings, drivers, and wiring.
3. Manufacturer and product series are indicated in the 'LIGHTING FIXTURE SCHEDULE' and constitute the type and quality of fixture to be provided. All published specifications of the manufacturer that correspond to the indicated catalog number, shall be considered as part of this specification even though they may not be shown in complete detail.
4. Manufacturer's product series indicate the general line of fixtures required and may not necessarily include all prefixes and suffixes for options, trim and/or configurations required.
5. Bid prices shall be based on information in all columns of the 'LIGHTING FIXTURE SCHEDULE'.
6. Where a conflict exists between the fixture description and the manufacturer's product series, the price shall include the more expensive option. Coordinate conflicts with engineer prior to submitting bid.
7. The listing of a manufacturer does not guarantee that manufacturer will have a product that meets the requirements put forth in the fixture description. Approval of specific fixtures by an approved manufacturer will be subject to review by the Specifier.
8. No substitutions shall be accepted unless listed.
9. Provide fixtures from a single manufacturer for each fixture type.
10. Pricing for light fixture types shall be through local lighting rep listed only.

B. General:

1. Ship fixtures factory assembled, complete in every respect, including all necessary parts, shown or not shown on the drawings, required for a complete installation in accordance with the manufacturer's recommendations.
2. EC to verify and provide fixture mounting options that are compatible with ceiling type as shown on the architectural drawings.

C. Listings:

1. Provide fixtures for use in damp or wet locations that are UL Listed for the specific installation.
2. Provide fixtures for recessed use in combustible construction that are UL Listed for the specific installation.

D. Fixture Construction:

1. Fixtures shall be designed with metal parts grounded as common unit.
2. Fixture housing shall be formed and supported to prevent warping and sagging.
3. Metal parts shall be free of burrs, sharp corners, and edges.
4. Doors, Frames, and Other Internal Access:
    a. Smooth operating, free of light leakage under operating conditions, and designed to permit access without use of tools.
    b. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally when secured in operating position.
5. Finishes:
    a. Manufacturers' standard, unless otherwise indicated.

2.2 DRIVERS

A. Manufacturers

1. Furnished with fixture as tested and recommended by fixture manufacturer as a complete lighting system.
2. All fixtures of the same type shall be furnished with the same manufactured driver type.

B. General:

1. All drivers shall be equipped with a disconnecting means internal to the fixture. The line side terminals of the disconnecting means shall be guarded. Provide Sta-Kon Series LD3 Luminaire Disconnect or equivalent.
2. LED driver shall be rated for dual 120/277 volt operation at 60 Hertz.
3. Drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”.

C. Emergency Battery Driver

1. General:

a. Comply with UL 924.
b. Self-contained, modular, battery-inverter unit factory mounted within fixture body.
c. Connect emergency battery driver to un-switched normal lighting circuit.

2. Battery:

a. Sealed, nickel cadmium with minimum 5-year nominal life.
b. Unit shall operate for a minimum of 90 minutes after power interruption.
c. Fully automatic current-limiting charger.

3. Battery Operation:

a. Relay automatically turns lamp(s) on when power supply circuit voltage drops to 80 percent of nominal voltage or below.
b. Lamp automatically disconnects from battery when voltage approaches deep-discharge level.
c. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Integral time-delay relay to hold unit on for fixed interval when power is restored after an outage.
e. Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
f. Test Switch and Light Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

2.3 EMERGENCY LIGHTING

A. Manufacturers

1. Provide lighting fixtures, of sizes, types and ratings indicated on the Drawings under the ‘LIGHTING FIXTURE SCHEDULE’ complete with, but not limited to, housings, drivers, and wiring.

B. Emergency Lighting Units:

1. General:

a. Self-contained units complying with UL 924.
b. Provide complete emergency battery units, including remote heads, as shown on drawings.

2. Battery:

   a. Sealed, nickel cadmium with minimum 5-year nominal life.
   b. Unit shall operate for a minimum of 90 minutes after power interruption.
   c. Fully automatic current-limiting charger.

3. Battery Operation:

   a. Relay automatically turns lamp(s) on when power supply circuit voltage drops to 80 percent of nominal voltage or below.
   b. Lamp automatically disconnects from battery when voltage approaches deep-discharge level.
   c. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Integral time-delay relay to hold unit on for fixed interval when power is restored after an outage.
   e. Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
   f. Test Switch and Light Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

2.4 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section 26 0529 “Hangers and Supports for Electrical Systems” for additional support components not specified below.

B. Single-Stem Hangers: ½” steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. T-Bar Support Clips: Provide Caddy Series 515 or equal from fixture manufacturer.

D. Ceiling Support System Wires:

1. General: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gauge.
2. Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Inspection:

1. Inspect each fixture for damage prior to installation. Replace damaged fixtures and components.
2. Examine areas, structure, and other conditions under which lighting fixtures are to be installed and supported.
3. Review room finish schedule on architectural drawings for ceiling construction in each area and verify details with ceiling installer. Provide hardware and additional supporting devices as necessary to install lighting fixtures in each area.
4. Where lighting fixtures are recessed into ceiling construction, obtain information from the ceiling installer as to the specific type of ceiling to be installed, and provide recommended hardware and trim.

B. General:

1. Install fixtures plumb, square, and level with ceiling and walls, and secure according to manufacturer's printed instructions and approved shop drawings.
2. Install lighting fixtures at locations and heights as indicated on drawings. Where mounting heights are not indicated, coordinate with architect prior to rough-in.

3. Install lighting fixtures in strict conformance with manufacturer's recommendations and instructions.
4. Tighten connectors and terminals, including set screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL and NEC.

C. Supports:

1. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight.
2. Able to maintain fixture position after cleaning or maintenance.
3. Provide support for fixture without causing deflection of ceiling or wall.
4. Fixture-mounting devices shall be capable of supporting a horizontal force of 100 percent of fixture weight and a vertical force of 400 percent of fixture weight.
5. Provide all necessary additional or auxiliary supporting steel for fixtures not mounted on building framework, and where necessary to span ceiling channels of suspended ceiling construction.
6. Support all fixtures directly from the building structure. Do not utilize any of the following items for support.

    a. Acoustic materials.
    b. Gypsum-base materials.
    c. Mechanical or plumbing items or equipment.
    d. Ceiling grid system.
    e. Ceiling grid system hangers.

7. Metal decking shall not be pierced for fixture support.

D. Wall-Mounted Fixtures:

1. Attached to junction box or as recommended by fixture manufacturer.
2. Do not attach fixtures directly to gypsum board.

E. Surface-Mounted Fixtures:

1. Secured to outlet box. Outlet box to be supported directly to structure.
2. Support fixtures that are centered in acoustical ceiling tile, independently with metal suspension bar spanning an electrical outlet box and clipped to the ceiling grid tees.
3. Support fixtures that are centered on ceiling grid structure independent of ceiling grid, using support clips that wrap around grid. The support clip shall include means for fixture mounting. Provide a wire hanger from clip to structure.
4. Support surface-mounted fixtures greater than 2' in length at a point in addition to the outlet box.

3.2 COORDINATION

A. Coordinate layout and installation of lighting fixtures and supports with other construction that penetrate ceilings or are supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

B. Sequence lighting fixture installation with other work to reduce the possibility of damage to fixtures during remainder of construction period.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized. Replace or repair malfunctioning fixtures and components.

C. During warranty period, replace fixtures that show any signs of corrosion.

D. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

3.4 ADJUSTING AND CLEANING

A. Remove protective wrapping on fixtures before installation of furniture, but after interior finish work, such as painting and carpeting, is completed.

B. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer. Lenses and louvers with dust, dirt, scratches, or fingerprints shall not be acceptable.

3.5 GROUNDING

A. Provide equipment grounding connections for all lighting fixtures. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

END OF SECTION 26 5100