HARRIMAN

Architects + Engineers

Westgate Shopping Center
Anytime Fitness
Portland, Maine

Project No. 11110

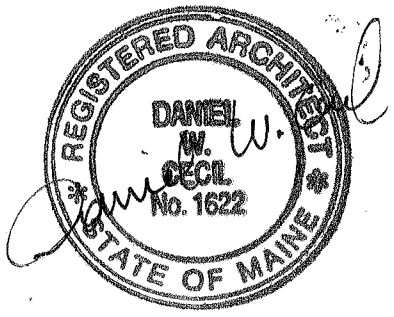
July 13, 2011

Issued for Construction

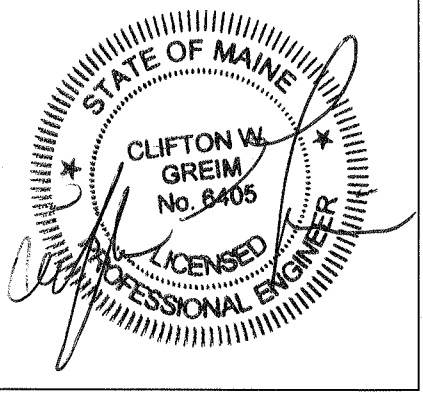
Auburn Business Park, 46 Harriman Drive, Auburn, Maine 04210 207-784-5100 www.harriman.com

PROFESSIONAL SEAL PAGE

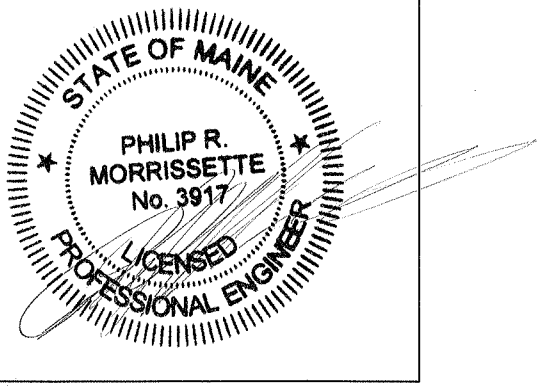
Architect
HARRIMAN



Mechanical Engineer
HARRIMAN



Electrical Engineer
HARRIMAN



WESTGATE SHOPPING CENTER
ANYTIME FITNESS
PORTLAND, MAINE

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LIST OF DRAWINGS

003000 - BID PROPOSAL
WESTGATE SHOPPING CENTER

Proposal from: _____
Name of Sub-contractor

_____
Address

_____

_____

_____
Telephone

_____
Date

Bid Due Date: To be determined

EXCLUSIONS:

Any and all work excluded in this bid shall be clearly stated and identified.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Westgate Shopping Center
Portland, Maine

OCCUPANCY DATE

The undersigned agrees to complete work on date(s) specified in these specifications and to commence his work immediately upon notification of Contract award.

COMPLETION DATE

The undersigned agrees to be substantially complete by:
To be determined

CONDITIONS FOR SIGNING

This Proposal must bear the written signature of the Bidder.

The Undersigned agrees that the Owner shall have the right top accept or reject any or all bids, and/or alternates.

The Undersigned agrees to be bound by the Breakout Prices, Unit Prices, and Alternates as furnished in this form, and certifies that he has included them in his Bid.

Respectfully submitted:

Name of Firm

By: _____

Title: _____

Date: _____

END OF BID PROPOSAL

DRAFT

AIA® Document A101™ – 2007

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

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

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

« »« »
« »
« »
« »

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

« »« »
« »
« »
« »

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

« »
« »
« »

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

« »

The Owner and Contractor agree as follows.

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

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

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

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TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

« »

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

« »

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

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than « » (« ») days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

« »

Portion of Work	Substantial Completion Date

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

« »

ARTICLE 4 CONTRACT SUM

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

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

« »

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

Item	Units and Limitations	Price Per Unit ($0.00)

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

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

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

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

« »

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

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported

by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

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

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

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

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

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

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

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

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

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

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

« »

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

§ 5.2 FINAL PAYMENT

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

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

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

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

« »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »
« »
« »

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

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

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

ARTICLE 7 TERMINATION OR SUSPENSION

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

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

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

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

« » % « »

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

« »
« »
« »
« »
« »
« »

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

« »
« »
« »
« »
« »
« »

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

§ 8.6 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

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

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

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

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

Section	Title	Date	Pages

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

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

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

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

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

« »

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

« »

ARTICLE 10 INSURANCE AND BONDS

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

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

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

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

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

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:	**PROJECT:**	**APPLICATION NO:** 001	**Distribution to:**
		PERIOD TO:	OWNER: ☐
		CONTRACT FOR: General Construction	ARCHITECT: ☐
FROM CONTRACTOR:	**VIA ARCHITECT:**	**CONTRACT DATE:**	CONTRACTOR: ☐
		PROJECT NOS: / /	FIELD: ☐
			OTHER: ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM	$	0.00
2. Net change by Change Orders	$	0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	$	0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)	$	0.00
5. RETAINAGE:		
a. 0 % of Completed Work (Column D + E on G703)	$	0.00
b. 0 % of Stored Material (Column F on G703)	$	0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703)	$	0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)	$	0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)	$	0.00
8. CURRENT PAYMENT DUE	$	0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$	0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$ 0.00	$ 0.00
Total approved this Month	$ 0.00	$ 0.00
TOTALS	$ 0.00	$ 0.00
NET CHANGES by Change Order	$ 0.00	

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $ 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract

AIA® Document G703™ – 1992

Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
	GRAND TOTAL	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	0.00 %	$ 0.00	$ 0.00

(2437205212)

AIA® Document G704™ – 2000

Certificate of Substantial Completion

PROJECT:
(Name and address):

PROJECT NUMBER: /
CONTRACT FOR: General Construction
CONTRACT DATE:

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

TO OWNER:
(Name and address):

TO CONTRACTOR:
(Name and address):

PROJECT OR PORTION OF THE PROJECT DESIGNATED FOR PARTIAL OCCUPANCY OR USE SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated above is the date of issuance established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

Warranty **Date of Commencement**

ARCHITECT	BY	DATE OF ISSUANCE

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment.

Cost estimate of Work that is incomplete or defective: $ 0.00

The Contractor will complete or correct the Work on the list of items attached hereto within Zero (0) days from the above date of Substantial Completion.

CONTRACTOR	BY	DATE

The Owner accepts the Work or designated portion as substantially complete and will assume full possession at (time) on (date).

OWNER	BY	DATE

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should determine and review insurance requirements and coverage.)

CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

AIA Document G706

(Instructions on reverse side)

OWNER	☐
ARCHITECT	☐
CONTRACTOR	☐
SURETY	☐
OTHER	☐

TO OWNER:
(Name and address)

ARCHITECT'S PROJECT NO.:

CONTRACT FOR:

PROJECT:
(Name and address)

CONTRACT DATED:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose.

   Indicate attachment: ☐ yes ☐ no

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR:
(Name and address)

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

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CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS

AIA Document G706A

(Instructions on reverse side)

OWNER	☐
ARCHITECT	☐
CONTRACTOR	☐
SURETY	☐
OTHER	☐

TO OWNER:
(Name and address)

ARCHITECT'S PROJECT NO.:

CONTRACT FOR:

PROJECT:
(Name and address)

CONTRACT DATED:

SAMPLE

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR:
(Name and address)

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

DRAFT

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

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

THE OWNER:
(Name and address)

THE ARCHITECT:
(Name and address)

TABLE OF ARTICLES

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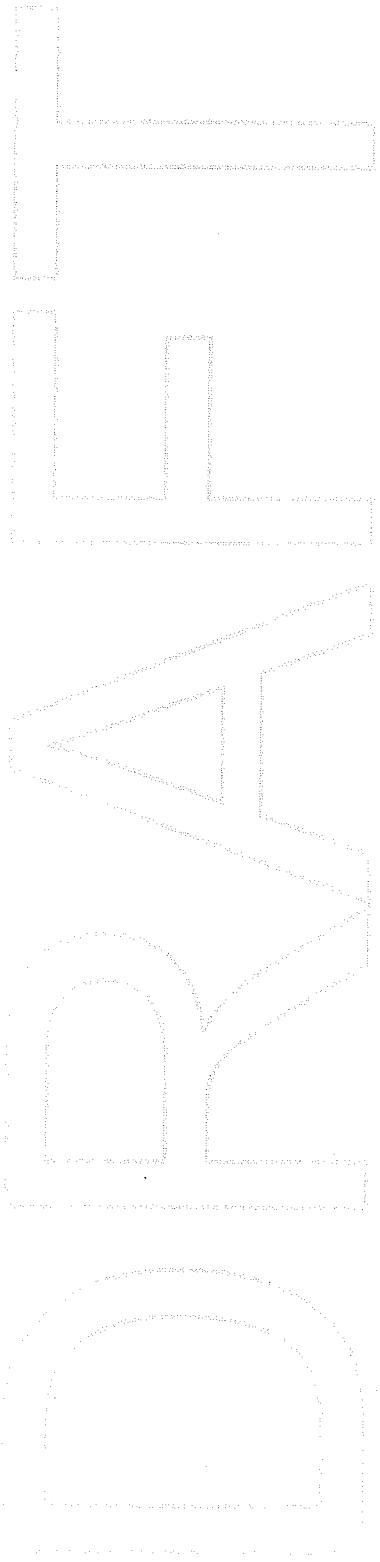


ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

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

§ 1.1.2 THE CONTRACT

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

§ 1.1.3 THE WORK

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

§ 1.1.4 THE PROJECT

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

§ 1.1.5 THE DRAWINGS

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

§ 1.1.6 THE SPECIFICATIONS

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

§ 1.1.7 INSTRUMENTS OF SERVICE

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

§ 1.1.8 INITIAL DECISION MAKER

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

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

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

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

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

§ 1.3 CAPITALIZATION

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

§ 1.4 INTERPRETATION

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

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

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

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

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

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

ARTICLE 2 OWNER

§ 2.1 GENERAL

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

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

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or

the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

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

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

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

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

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

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

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

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

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

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

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

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

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

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

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

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

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

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

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

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

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other

facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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

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

§ 3.5 WARRANTY

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

§ 3.6 TAXES

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

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

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

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

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

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

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume

the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

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

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

§ 3.9 SUPERINTENDENT

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

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

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

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

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

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

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

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

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

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be

required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

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

§ 3.14 CUTTING AND PATCHING

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

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

§ 3.15 CLEANING UP

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

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

§ 3.16 ACCESS TO WORK

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

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

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

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

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

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

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

§ 4.2 ADMINISTRATION OF THE CONTRACT

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

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

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

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

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

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

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

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

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

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

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

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

§ 5.3 SUBCONTRACTUAL RELATIONS

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

be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

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

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 MUTUAL RESPONSIBILITY

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that

the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

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

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

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

§ 6.3 OWNER'S RIGHT TO CLEAN UP

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

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

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

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

§ 7.2 CHANGE ORDERS

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

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

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

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

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

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

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

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

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

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

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

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

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

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

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

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

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

§ 7.4 MINOR CHANGES IN THE WORK

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

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

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

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

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

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

§ 8.2 PROGRESS AND COMPLETION

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

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

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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

§ 9.2 SCHEDULE OF VALUES

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

§ 9.3 APPLICATIONS FOR PAYMENT

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

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

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

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

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

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

.1 defective Work not remedied;

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

.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a separate contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

§ 9.6 PROGRESS PAYMENTS

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

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

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

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

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

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

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

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect,

stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

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

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

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

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

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

§ 9.9 PARTIAL OCCUPANCY OR USE

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

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

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

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the

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

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

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

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

- **.1** liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents; or
- **.3** terms of special warranties required by the Contract Documents.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

§ 10.2 SAFETY OF PERSONS AND PROPERTY

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

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

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

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

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

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

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

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

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

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

§ 10.3 HAZARDOUS MATERIALS

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

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

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

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

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

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

§ 10.4 EMERGENCIES

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

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

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

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

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

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

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

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

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

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

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

of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

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

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

§ 11.2 OWNER'S LIABILITY INSURANCE

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

§ 11.3 PROPERTY INSURANCE

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

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

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

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

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

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or

otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

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

§ 11.3.3 LOSS OF USE INSURANCE

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

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

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

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

§ 11.3.7 WAIVERS OF SUBROGATION

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

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

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the

Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

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

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

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

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

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

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

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

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

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

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

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

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

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

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

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

§ 13.2 SUCCESSORS AND ASSIGNS

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

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

§ 13.3 WRITTEN NOTICE

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

§ 13.4 RIGHTS AND REMEDIES

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

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

§ 13.5 TESTS AND INSPECTIONS

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

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

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

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

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

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

§ 13.6 INTEREST

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

§ 13.7 TIME LIMITS ON CLAIMS

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

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

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

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

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

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

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

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

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

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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

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

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

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

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

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

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

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

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

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

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

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

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

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

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

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

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

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

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

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

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

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

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

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

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

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

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

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

§ 15.2 INITIAL DECISION

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

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

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

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

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

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

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

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

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

§ 15.3 MEDIATION

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

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

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

§ 15.4 ARBITRATION

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

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

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

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

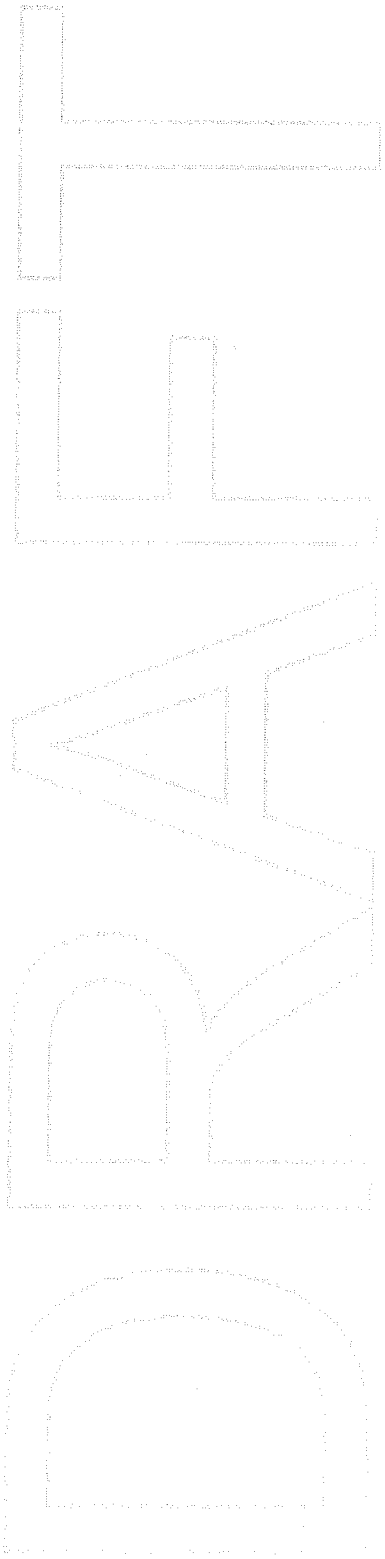
§ 15.4.4 CONSOLIDATION OR JOINDER

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

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an

additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

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



SUPPLEMENTARY CONDITIONS

THESE SUPPLEMENTARY CONDITIONS constitute changes, modifications, additions and deletions to "General Conditions of the Contract for Construction" (AIA Document A201, 2007 Edition) (the "General Conditions") which are incorporated by reference in the "Standard Form of Agreement Between Owner and Contractor" (AIA Document A101, 2007 Edition) by and between Charter Westgate, LLC, as Owner, and _____, as Contractor (the "Basic Agreement"). In the event of any conflict between these Supplementary Conditions and the General Conditions, or between these Supplementary Conditions and any general conditions contained in the bidding documents, these Supplementary Conditions shall control.

1.2 EXECUTION, CORRELATION AND INTENT

Add the following subparagraphs:

1.2.4 If Contractor discovers that the Contract Documents or any portion of the Work (whether or not completed or covered) do not comply with requirements of Laws, Contractor shall notify Owner and Architect thereof promptly in writing.

1.2.5 Contractor shall be responsible for having taken all steps necessary to ascertain the nature of the Work and the general and local conditions which can affect the Work or the cost thereof. Any failure of the Contractor to do so will not relieve it from responsibility for successfully performing the Work without additional expense to Owner, except as otherwise expressly set forth to the contrary in the Contract Documents.

ARTICLE 7 - CHANGES IN THE WORK

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.5: In line 2, place a period after the word "involved" and replace the remainder of the subparagraph with the following:

Together with Contractor's submission of any Contractor-proposed change in the Work or within seven (7) days after receipt of an Owner or Architect-originated proposed Change Order or Construction Change Directive, Contractor shall advise Owner in writing if Contractor will claim an increase in the Contract Sum and/or the Contract Time for the Work covered by such Contractor-proposed change or Owner or Architect-originated proposed Change Order or Construction Change Directive. Contractor shall state the amount of such increase, together with such detailed cost and other supporting data as Owner or Architect may reasonably request. If Contractor does not provide such written advice together with Contractor's submission of Contractor's proposed change or within seven (7) business days of Contractor's receipt of the Owner or Architect-proposed Change Order or Construction Change Directive, Owner shall not be liable for any increase in the Contract Sum or Contract Time with respect to such proposed Change Order or Construction Change Directive. Should Contractor determine that accurate pricing of additional cost incurred by virtue of a change in the Work shall reasonably require more than the seven (7) day business period set forth this Subparagraph 7.3.4, then Contractor shall so notify Owner in writing within such seven (7) business day period and notify Owner of the additional time required, which additional time shall in no event exceed an additional seven (7) business days.

7.3.7: In lines 4, delete the words "a reasonable amount" and substitute, "an allowance for overhead and profit in accordance with Clauses 7.3.11.1 through 7.3.11.6 below."

Add the following subparagraphs:

7.3.11 In Subparagraph 7.3.6, the allowance for combined overhead (including general conditions) and profit included in the total cost to Owner shall be based on the following schedule:

1. For Contractor, for Work performed by Contractor's own forces, (a) _____[**to be taken from Contractor's bid as accepted by Owner]** percent of the costs of such Work for overhead and profit (i.e., fee) plus (b) the actual out-of-pocket net costs to Contractor for any increase in General Conditions.

2. For Contractor, for Work performed by a Subcontractor or Sub-subcontractor, (a) _____ percent [**to be taken from Contractor's bid as accepted by Owner]** of the amount due Contractor's Subcontractor for overhead and profit (i.e., fee) plus (b) the actual out-of-pocket net costs to Contractor for any increase in General Conditions.

3. For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor or Sub-subcontractor's own forces, ten (10) percent of the costs of such Work.

4. For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, ten (10) percent of the amount due the Sub-subcontractor.

5. Costs to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

7.3.12 Contractor shall not be entitled to any increase in the Contract Sum for any change in the Work required by reason of Contractor's fault, inaccuracy, errors, omissions, or negligence.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1: Delete in its entirety and replace as follows:

8.3.1: Except as otherwise expressly set forth in this Agreement or otherwise agreed to in writing by Owner and Contractor, the Contract Time shall not be extended for any reason whatsoever, other than on account of strikes occurring on the job during the performance of the Work which are industry-wide and not specific to Contractor, riots, civil commotions, fire, flood and other like casualty, unusual delays in deliveries and other similar causes of delay beyond the control of Contractor and which Contractor could not have reasonably anticipated (and by so anticipating been able to take reasonable action to avoid such delay), delays caused by an act or neglect of Owner or Architect or of an employee of either, or of a separate contractor employed by Owner, and for delays caused by Change Orders or Construction Change Directives, subject however, to Contractor's compliance with the terms and conditions of Subparagraph 7.3.4.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.3 APPLICATIONS FOR PAYMENT

9.3.1: Add the following at the end of this subparagraph:

All Applications for Payment shall be accompanied by full, complete, and true copies of Subcontractors'

submissions for payment as same may have been reduced or modified by Contractor; bills of sale in form satisfactory to Owner, and Owner's lender (if any), all of the foregoing in respect of Work performed through the end of the calendar month preceding the calendar month in which the Application for Payment is submitted. The Application for Payment shall also be accompanied by Owner's prior approved Schedule of Values showing as to each portion of the Work and each phase thereof the percentage of completion through the end of such preceding calendar month. The form of Application for Payment shall be AIA Document G702 "Application and Certificate for Payment" (as then currently revised), supported by AIA Document G703, Continuation Sheet (as then currently revised) and shall be accompanied by partial waivers of lien executed by Contractor and all subcontractors in a form that complies with Mass. Gen. L. c.254 and is acceptable to Owner's lender, reflecting payment received through the date of the Application. Nothing in these Contract Documents shall be construed to require Contractor to waive its rights to file a lien or otherwise claim for amounts due and payable under this Agreement and not paid by Owner to Contractor.

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1: In line 2, after the word "Contractor" insert, "and Owner".

11.1.3.: In line 3, after the word "shall" insert, "name Owner and any other party requested by Owner as additional insureds and"

Add the following subparagraphs:

11.1.5 All insurance policies must be in form and content acceptable to Owner and Owner's lender (if any) and shall be written on an "occurrence" rather than a "claims made" basis. Owner and Owner's lender (if any) shall be named as additional insureds on the Commercial General Liability and Automobile Liability policies.

11.1.6 The required coverages and limits of liability insurance are more particularly described as follows:

11.1.6.1 Workers Compensation and Employer's Liability Insurance:

Worker's Compensation:	
State:	Statutory
Applicable Federal:	Statutory
Employer's Liability:	$1,000,000
Benefits required by Union labor contracts:	As applicable

11.1.6.2 Commercial General Liability Insurance: The base coverage shall be in a combined single limit per occurrence for personal injury and property damage of not less than $3,000,000. Such insurance shall also include:

(a) Products and Completed Operations Insurance, which shall be maintained for at least four (4) years after final payment; Contractor shall provide evidence of such coverage to Owner on an annual basis during such period; and

(b) Blanket Contractual Liability Insurance;

11.1.6.3 Comprehensive Automobile Liability Insurance, covering owned, lease or rented vehicles, in the minimum amount of $3,000,000, combined single limit per occurrence.

11.1.6.4 Umbrella Liability: $2,000,000.

11.1.6.6. Should any loss occur under any of Contractor's required insurance policies, Contractor shall be liable for the amount of any deductible specified in such policy.

END OF SUPPLEMENTARY CONDITIONS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Drawings, Specifications, general provisions of the Contract, including General and Supplementary Conditions, addenda and modifications.

1.2 PERMITS

A. Contractor shall obtain permits for the work under this contract, including Building, Electrical, and Plumbing permits.

1.3 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

B. Submit a detailed sequence of work to Owner for review and approval before starting work.

1.4 USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor=s use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

B. Use of the Site: Limit use of the premises to work in areas indicated. Coordinate use of premises and areas outside of the Work with the Landlord.

C. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, adjacent tenant, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1.5 MISCELLANEOUS PROVISIONS

A. The Contractor will use all reasonable efforts to minimize interference with any tenant=s business as a result of the Work and will not obstruct the entrance doors to any tenant=s premises@.

END OF SECTION 011000

SECTION 013100 - 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. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination Drawings.
   2. Administrative and supervisory personnel.
   3. Project meetings.

B. Related Sections include the following:
   1. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction 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 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 and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical. Coordinate location of pipes, conduits, ducts and similar items in confined areas to assure proper fit and access. Contractor is responsible for handling interferences created by the work of subcontractors (example, sprinkler pipe interfering with installation of duct work; duct work interfering with installation of light fixtures).
   5. Coordinate the work to provide smoke and fire seals for component interfaces and penetrations of smoke walls and fire rated construction.

B. Coordinate with contractors doing work for the Owner under separate contracts.

C. 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.

D. 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. Startup and adjustment of systems.
   9. Project closeout activities.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings as determined by the Contractor and subcontractors, if there is limited space availability, and provide maximum utilization of space for efficient installation of different components, and for coordination for installation of products and materials fabricated by separate entities.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of architectural, structural, mechanical, and electrical systems.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
   2. Number of Copies: Submit two opaque copies of each submittal. Architect will return one copy.
   3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
   1. Include special personnel required for coordination of operations with other contractors.

1.6 PROJECT MEETINGS

A. General: 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: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. 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. Progress reports.
    e. Designation of key personnel and their duties.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for requests for interpretations (RFIs).
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of Record Documents.
    m. Use of the premises.
    n. Work restrictions.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Construction waste management and recycling.
    r. Parking availability.
    s. Office, work, and storage areas.
    t. Equipment deliveries and priorities.
    u. First aid.
    v. Security.
    w. Progress cleaning.
    x. Working hours.
3. Minutes: Record and distribute meeting minutes.
    a. Include action items and responsible party.

C. Preinstallation Conferences: 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. The Contract Documents.
    b. Options.
    c. Related requests for interpretations (RFIs).
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written recommendations.
    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. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.
    z. Record drawing process.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
    a. Include action items and responsible party.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
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. Monthly Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
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 shall be represented at these meetings. All participants at the conference shall 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. Determine how construction behind schedule will be expedited; secure commitments from parties involved to

do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Application for Payment: Contractor shall bring copy of Application for Payment to meeting. Review Application for Payment and required attachments, including record drawing and documents status, waivers of mechanic's liens, list of completed tests, checklists, commissioning, reports, and similar requirements for the work are submitted and in compliance with the Contract Documents.

c. 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) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Requests for interpretations (RFIs).
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.
21) Progress reports.

3. Minutes: Record and distribute the meeting minutes.

a. Include action items and responsible party.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

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/Progress Meetings: Conduct Project coordination/progress meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall 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. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be 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) Status of submittals.
   4) Deliveries.
   5) Off-site fabrication.
   6) Access.
   7) Site utilization.
   8) Temporary facilities and controls.
   9) Work hours.
   10) Hazards and risks.
   11) Progress cleaning.
   12) Quality and work standards.
   13) Change Orders.

3. Conduct coordination meetings with the mechanical, plumbing, sprinkler and electrical trades. Before the trades start work in an area of the building, review structural clearances and locations of ducts, pipes, conduits, light fixtures, equipment and other items that affect location and proper fit. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components. Verify depths and clearances before fabrication of ductwork.

4. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
   a. Include action items and responsible party.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work in this section consists of all construction related administration, meetings, and all submittals required for construction.

1.2 JOB SITE ADMINISTRATION

A. The Contractor shall keep an authorized supervisory representative on site during all working hours who shall act as the agent of the Contractor.

B. The supervisory representative on the contract work shall be a competent English-speaking superintendent capable of reading and thoroughly understanding the drawings and specifications, with full authority to promptly fulfill the Contractor's duties and responsibilities on the job.

C. The Contractor's supervisory representative shall be subject to the approval of the Owner. The supervisory representative shall not be removed from the work without prior written consent of the Owner. If in the opinion of the Owner or Architect, the supervisory representative or any of his successors, proves incompetent, not conscientious or not industrious, then the Contractor shall replace him within 10 calendar days with another person approved by the Owner at no additional cost to the Owner. Approval shall not, in any way, relieve or diminish the Contractor's responsibility for supervision of the work.

1.3 CONSTRUCTION MEETINGS

A. Construction meetings shall be held bi-weekly at the site by the Architect, Owner and Contractor. The Contractor and all Subcontractors working on the project within that week shall be in attendance. Meeting minutes will be maintained by the Contractor and forwarded to Architect, the subcontractors and all other Contractors prior to the next weekly meeting. Before initiation of the work a schedule shall be agreed upon for the day, time and place of the weekly construction meetings.

B. The Rough Agenda for the Bi-Weekly Meeting Will Be as Follows:
   1. Review previous meeting notes.
   2. Construction schedule (current and planned).
   3. Submittals.
   4. Problems.
   5. New items.
   6. Changes.

C. Submit a Progress Schedule, with a minimum of 100 activities showing the starting and completion dates of each activity, at the Pre-Construction Meeting. The Progress Schedule shall be in the form of a Gant Bar Chart or CPM Chart and shall indicate week numbers, weeks and durations of activities. See sample form at the end of this Section.

1.4 COORDINATION

A. Coordinate work of the various sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

B. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

C. In finished areas except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

1.5 REFERENCE STANDARDS

A. For Products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. The date of the standard is that in effect as of the Bid date, except when a specific date is specified.

C. Obtain copies of standards when required by Contract Documents. Maintain copy at job site during progress of the specific work.

1.6 CHANGE ORDERS REQUEST

A. Should the Owner request a price for contemplated changes in the work, the Contractor shall promptly advise, within 14 calendar days, the Architect, in writing, as to credit or cost proposed for the described change. The Contractor's written reply shall include a cost breakdown with appropriate back-up by Division of the proposed change in Contract Sum and extension of time required, if any.

1.7 SUBMITTALS

A. General Provisions:
   1. Make all submittals including Samples, Shop Drawings, and Project Data within 45 calendar days of Notice of Award.
   2. Provisions in this section are mandatory procedures for preparing and submitting Samples, Shop Drawings, and Product Data.
   3. Job delays occasioned by requirement of re-submission of samples, Shop Drawings, and Product Data not in accord with Contract Documents are Contractor's responsibility and will not be considered valid justification for extension of time.
   4. Heating, pumping, and piping systems shop drawings shall be prepared by the licensed installing contractors, and shall note the name(s), license number(s), and license expiration date(s) of the contractor(s) installing the systems.

B. Submittals Schedule:
   1. Contractor shall submit proposed submittals schedule to Owner and Architect for review within ten calendar days following Notice of Award.
   2. Schedule Purpose is to:
      a. Demonstrate that submittals, shop drawings, data, samples and mock-ups required for

Work are addressed by Contractor.

b. Assist Architect in scheduling timely review of submittals.

3. Schedule Contents: Description of submitted item, proposed date of submittal and proposed date of requested return by Architect.
4. Contractor shall submit accepted schedule within ten calendar days after joint review date.

C. Product Data:
1. Contractor shall include product manufacturer's standard printed material, dated, with product description and installation instructions indicated; delete data not related to this Project or mark "VOID" as applicable.
2. Number of Copies Submitted: Number required by Contractor plus four which will be retained by Architect and Owner.

D. Shop Drawings:
1. Contractor shall conform to the following requirements:
   a. Number sheets consecutively.
   b. Indicate working and erection dimensions and relationships to adjacent work.
   c. Indicate:
      (1) Arrangements and sectional views, as applicable.
      (2) Material, gauges, thickness, finishes, and characteristics.
      (3) Anchoring and fastening details; include information for making connections to adjacent work.
   d. Cross-reference drawing details and specification paragraphs applicable to submitted data.
2. Contractor shall submit one sepia transparency and three black line prints of shop drawings.
3. Photocopy, autopositive, or other reproduction of Architect's Drawings are not acceptable for Subcontractors' or Vendors' Shop Drawings.

E. Samples:
1. Contractor shall prepare samples in sizes, shapes, and finishes in accord with provisions of individual specification sections.
2. Samples furnished under this section are not to be confused with full-size, on-the-site "Mock-Ups" called for in some specification sections.
3. Number of samples submitted: Number required by Subcontractor, plus two which will be retained by Architect and Owner, unless otherwise indicated. Additional samples shall be furnished as requested.

F. Quality Control Submittals: Certificates: Contractor shall submit certificates from manufacturers for each product indicating materials supplied or installed are asbestos-free.

G. Operations and Maintenance Manuals: Submit to Architect for review. All copies will be returned to contractor for final distribution to Owner. See Division 01 Section PROJECT RECORD DOCUMENTS for more information.

H. Review:
1. Contractors:
   a. Review submittals and stamp with approval action stamp containing Contractor's name,

word "Approved," signed initials of approving agent, date of approval action, review notes, comments, and corrections required prior to submission to Architect. By so noting, Contractor indicates that he has reviewed and approves materials, equipment, quantities, and dimensions represented by particular submittal.

b. Contractor represents by submitting samples, Shop Drawings, and Product Data that he has complied with provisions specified. Submissions made without Contractor's approval indicated thereon will be returned without being reviewed for compliance with this requirement.

c. Date each submittal; indicate name of Project, Contractor, Subcontractor, as applicable; description or name of equipment, material, or product; and identify Work use location.

d. Accompany submittal with transmittal letter containing Project name, Contractor's name, number of samples or drawings, titles, and other pertinent data. Outline deviations, if any, in submittals from requirements of Contract Documents.

2. Architects:

a. Review submittals within ten calendar days of receipt from Contractor.

I. Resubmission: Contractor shall make corrections and changes indicated for rejected submissions; resubmit in same manner specified above until Architect no longer requires re-submission.

J. Distribution: Contractor is responsible for obtaining and distributing copies of submittals to his Subcontractors and Material Suppliers. Make prints of reviewed Shop Drawings from transparencies imprinted with Architect's appropriate stamp.

1. Contractor shall maintain at the present site an orderly file of all approved submittals bearing Architect's stamp for Project duration.

1.8 REQUEST FOR INFORMATION

A. Should the Contractor require additional information or clarification regarding the work, a written request using the R.F.I. form attached at the end of this Section shall be submitted to the appropriate party.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable)

END OF SECTION 013300

REQUEST FOR INFORMATION

Contractor _____ R.F.I. Number _____

Address _____ Date _____

Telephone _____
Fax _____

To dellingson@harriman.com; cmcconnell@harriman.com
From _____ Please answer by _____

PROBLEM/CONFLICT:

_____
_____
_____
_____
_____
_____
_____

CONTRACTOR'S RECOMMENDED SOLUTION:

_____
_____
_____
_____
_____
_____
_____

ARCHITECT/ENGINEER'S RESPONSE: Date: _____ See Attachment:

_____
_____
_____
_____
_____
_____
_____

Response by: cc: Owner _____

_____
_____
_____
_____
_____
_____

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 CONSTRUCTION LAYOUT

A. The Contractor shall take the responsibility for verifying and locating existing systems and laying out his work in three dimensions in accordance with the drawings and with great accuracy in establishing and maintaining dimensional control so that it will agree with established lines and levels. All changes from the plans issued for permit shall be noted on the permit set. The permit set shall be turned over to the Architect after completion. Final retainage will not be released without the "As Built" permit submittal.

B. Any discrepancy between drawings and existing conditions shall be brought to the attention of the Architect immediately describing such discrepancies. Work shall not proceed until he has received written instructions. The Contractor and Architect shall follow-up such communications in writing.

1.2 TESTS AND INSPECTIONS

A. The Contractor shall coordinate with the testing agency hired by the Owner making the tests and inspections of workmanship and materials as may be required by the Building Code, State and municipal laws, and as required under the various sections of the specifications.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable)

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 TEMPORARY SCAFFOLDING AND CONVEYANCES

A. The Contractor shall furnish, install, maintain, remove and pay for all temporary staging and planking, ladders, hoisting including operator, rigging and safety devices as required for work covered under his contract.

1.2 PARKING

A. The Contractor will be permitted to park employees' passenger cars (and subcontractors' employees) on the site where directed by the Owner. The Owner will not be responsible for cars parking on the site. The Contractor shall be responsible for any damage to paving, curbing, landscaping, etc., and shall repair or restore any damage to parking lot incurred during construction of project, to the satisfaction of the Owner.

1.3 TEMPORARY SERVICES

A. Temporary Water: The Contractor shall provide potable drinking water supply, satisfactorily cooled, for all employees.

B. Temporary Telephone:
   1. Install a job telephone and answering machine or cellular phone system.
   2. Make arrangements and pay costs for installation and operation of telephone service for Contractor's Offices, including monthly charges and necessary accounting of toll calls. Long distance and toll calls shall be paid for by the party making the call.

1.4 TEMPORARY ENCLOSURES, VENTILATION AND HEAT

A. Temporary Enclosures: Provide temporary weathertight enclosures for all exterior openings so as to protect all new and existing work and equipment from the weather.

B. Provide protection of work at all times against rain, wind, storm, frost or the heat, to maintain all work, materials, apparatus and fixtures free from injury or damage. At the end of the day’s work, all new work likely to be damaged shall be protected.

C. Temporary Ventilation: Provision shall be made during construction to allow the escape of "Construction Moisture" by use of a breathing type enclosure on at least part of the openings, or by mechanical ventilation.
   1. All spaces shall be mechanically ventilated to protect occupants from application and installation of odor causing materials. The area where material is being used shall be isolated from the new or existing ventilation system. No work creating fumes shall be done in an existing building while it is occupied by the Owner. Ventilation shall be maintained for a period of 24 hours or until release of fumes has subsided, whichever is longer.

1.5 PRECAUTION AGAINST FREEZING

A. The work must be carried on without interruption despite adverse weather and temperature conditions and the Contractor shall provide such protection and conduct his work in such a manner as will avoid delay or damage to the work.

1.6 SITE PROTECTION

A. Barricades, Warning Signs, and Lights: Provide barricades and other safety precautions as required to insure the protection of the public as well as employees and others whose duties require their presence on the premises at the project site. Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights. Provide and maintain guard lights at all barricades, obstructions in streets and sidewalks and all trenches and pits.

1.7 RESTORATION OF ROADWAYS AND PAVEMENTS

A. Roadways, pavements and curbs that are broken, damaged, settled, or otherwise defective as a result of receiving, handling, storage of materials or the performance of any work under this Contract, shall be fully restored to the satisfaction of the authorities having jurisdiction.

1.8 SNOW REMOVAL

A. Remove snow from access to and within limit of work lines which impairs progress of work, is detrimental to workmen, or impairs trucking delivery or moving of materials at the site.

1.9 CONSTRUCTION SITE SIGN

A. The Contractor shall install a temporary sign, in a location where directed by Owner's Representative.

B. Contractor shall observe all local ordinances concerning temporary signs for the project and shall obtain permits for any and all temporary signs erected on site.

1.10 SECURITY

A. Full responsibility shall be placed on the General Contractor as a professional builder to construct safely and to protect the building and contents and its occupants, regardless of the information given herein which is only a general description of minimum work to be performed.

B. All excavations shall be protected and well marked with fences or barriers and as required by appropriate Public Officials and other sections of these specifications.

C. Loss of business or damage to structures, to store fixtures, or to products therein caused by construction under this Contract shall be repaired, replaced, or paid for by this Contractor at no cost to the Owners.

D. This Contractor shall restore to its original condition any portion of the permanent structure or

equipment which is damaged by the Contractor or his subcontractor's operations.

1.11 DUMPSTERS

A. Dumpsters: Contractor shall provide dumpsters for construction debris. Dumpsters shall be regularly emptied such that materials do not spill onto the ground.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 015000

SECTION 016000 - PRODUCT 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 includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
   1. Division 01 Section “Substitutions and Product Options” for procedures and requirements for product substitutions.
   2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   3. Divisions 02 through 26 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased 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, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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.

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

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

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. Comply with manufacturer's written instructions.

B. 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 ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

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: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
   3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. 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, that are undamaged and, unless otherwise indicated, that 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. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
   6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
   7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Division 01 Section “Substitutions and Product Options” to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
   3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
   4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
   5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies

with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 016300 - SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Substitution procedures during the bid period shall be followed to provide equality of bids. The Architect and Owner are not obligated to consider substitutions submitted after bids are received. Contractors submitting substitutions after bids are received will not be given additional compensation for rejected submittals.

1.2 SUBSTITUTIONS

A. Submit two copies of request for substitution. Include in the request:
   1. Complete data substantiating compliance of proposed substitution with Contract Documents.
   2. For products:
      a. Product identification including manufacturer's name and address.
      b. Manufacturer's Literature:
         (1) Product description.
         (2) Performance and test data.
         (3) Reference standards.
      c. Samples.
      d. Name and address of similar projects on which product was used, and date of installation.
   3. Itemized comparison of product substitution with product specified.
   4. Changes in construction schedule.
   5. Accurate cost data on proposed substitution in comparison with product specified.

B. In Making Request for Substitution, the Contractor Represents:
   1. He has investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
   2. He will provide the same or greater guarantee for substitution as for product specified.
   3. He will coordinate installation of accepted substitution into work, making such changes as required for work to be completed.
   4. He waives all claims for additional costs related to substitution in which it becomes apparent before, during or after installation.
   5. Contractor requesting substitution shall bear additional costs to all parties due to his substitution, including Architect's fees.

C. Substitutions Will Not Be Considered If:
   1. They are indicated or implied on shop drawings or project submittals without formal request.
   2. Acceptance will require substantial revision of Contract Documents.
   3. Not readily serviceable in the area or may cause Shaw's to stock extra parts.

D. Substitutions not approved before the last addendum is distributed shall not be considered in the Base Bid.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 016300

SECTION 017100 - CLEANING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Execute cleaning, during progress of the work, and at completion of the work, as required by General Conditions.

1.2 RELATED REQUIREMENTS

A. Conditions of the contract.

B. Each Specification Section: Cleaning for specific products or work.

1.3 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with all local codes, ordinances, regulations and anti-pollution laws.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 DURING CONSTRUCTION

A. Execute periodic cleaning, not less than weekly, to keep the work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically, and dispose of at legal disposal areas away from the site.

3.2 PROGRESSIVE CLEANING

A. Cleaning during construction is the responsibility of the Contractor.

3.3 FINAL CLEANING

A. Final cleaning before final inspection. Interior and exterior areas of the building shall be cleared of all rubbish and thoroughly cleaned by the Contractor, including the following:
   1. All construction facilities, debris, and rubbish shall be removed from the Owner's property and legally disposed of.
   2. All finished surfaces including floors, walls and ceilings shall be swept. This includes cleaning of the work of all finished trades where needed, whether or not cleaning for such trades is included in their respective Sections.
   3. Pipe and duct spaces, chases, and furred spaces shall be left thoroughly cleaned.

B. Ventilating Systems:
   1. Clean permanent filters.
   2. Clean ducts, blowers and coils if units were operated without filters during construction.

C. Broom clean exterior paved surfaces, rake clean other surfaces of the grounds disturbed by construction.

D. Prior to final completion or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

END OF SECTION 017100

SECTION 017329 – CUTTING AND PATCHING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections of these Specifications for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

C. Contractor is responsible for cutting, fitting or patching required to complete the Work or to make its part fit together properly. Contractor shall not damage or endanger a portion of the Work or fully or partially completed Work by cutting, patching or otherwise altering such construction, or by excavation.

1.2 GENERAL REQUIREMENTS

A. Take all precautions to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

B. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually satisfactory manner.
   1. Retain the original installer or fabricator to cut and patch work, or if it is not possible engage a recognized experienced and specialized firm.
   2. Coordinate cutting and patching work with pattern or joints of exposed finished work. Extend perimeter cut if no additional structural or safety involvement is encountered to allow for blending of finished material or pattern.

1.3 DEFINITION

A. “Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.

B. “Cutting and patching" is performed for coordination of the work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes.

C. Cutting and patching performed during the manufacture of products, or during the initial fabrication, erection or installation processes is not considered to be "cutting and patching" under this definition. 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 categories of work, which may or may not require cutting and patching as defined in this Section; refer to Division 02 Section "Selective Demolition".

1.4 SUBMITTALS

A. Cutting and Patching Proposal: The following procedures are required for structural elements, before proceeding, submit a proposal describing procedures in advance of the time cutting and patching will be performed. Include the following information:
   1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
   2. Describe anticipated results; include changes to structural elements and operating components and changes in the building's appearance and other visual elements.
   3. List products to be used and entities that will perform Work.
   4. Indicate dates when cutting and patching is to be performed.
   5. List utilities that will be disturbed, including those that will be relocated and those that will be temporarily out-of service. Indicate how long service will be disrupted.
   6. Approval by the Architect to proceed does not waive the Architect's right to later require complete removal and replacement of Work found to be unsatisfactory.

1.5 QUALITY ASSURANCE

A. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

B. Performance: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
   1. Cut existing construction to provide for the installation of other components or the performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

1.6 PROJECT CONDITIONS

A. Provide tenting or barriers as necessary to protect adjacent finished work and equipment from dust and debris.

B. Provide water dams and control for cutting operations, which require water dispersal of cuttings.

C. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio. Obtain the Architect's approval to proceed with cutting and patching before cutting and patching the following structural elements:
   1. Foundation construction.
   2. Bearing and retaining walls.
   3. Structural concrete.
   4. Lintels.
   5. Structural decking.
   6. Miscellaneous structural metals.
   7. Exterior curtain wall construction.
   8. Equipment supports.
   9. Piping, ductwork, vessels and equipment.

1.7 OPERATIONAL AND SAFETY LIMITATIONS:

A. Operational and Safety Limitations: Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems.

B. Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life, safety, or energy performance.

C. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.
   1. Shoring, bracing, and sheeting.
   2. Primary operational systems and equipment.
   3. Air or smoke barriers.
   4. Water, moisture or vapor barriers.
   5. Membranes and flashings.
   6. Fire protection systems.
   7. Noise and vibration control elements and systems.
   8. Control systems.
   9. Communication systems.
   10. Electrical wiring systems.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials: Use materials identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible. Use materials whose performance will equal or surpass of existing materials.

PART 3 – EXECUTION

3.1 EXAMINATION/ PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

3.2 EXECUTION

A. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review procedures with the original installer; comply with the original installer's recommendations.
   1. Where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots to size required with minimum

disturbance of adjacent surfaces. Temporarily cover openings when not in use. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

2. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
3. Comply with requirements of applicable sections where cutting and patching requires excavating and backfilling.
4. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

B. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. 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.
3. Where the removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
    a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
4. Patch, repair or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.3 VISUAL REQUIREMENTS

A. Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Owner's Construction Manager’s opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work which has been cut and patched in a visually unsatisfactory manner.

3.4 PROTECTION

A. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.

3.5 CLEAN UP

A. Cleaning: Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove paint, mortar, oils, putty and similar items. Thoroughly clean piping, conduit and similar features before painting or finishing is applied. Restore damaged pipe covering to its original condition.

B. Inspect area with Architect and Project Manager prior to removing barriers. Repair areas where barriers have marred surface of finished work.

C. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 017329

SECTION 017400 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor's Requirements: Prepare, assemble and transmit the items listed herein to the Architect as condition precedent of Certificate of Substantial Completion.

B. Related Sections:
   1. Division 01 Section “Project Record Documents”.
   2. Each respective section of specifications listing Warranties or Bonds required.

1.2 CONTRACTOR'S SUBMITTALS

A. Requirements:
   1. Assemble warranties, bonds, service and maintenance contracts, and Subcontractor data.
   2. Number of Original Signed Copies Required: Four each.
   3. Table of Contents: Type neatly in orderly sequence. Provide complete information for each item.
      a. Product or work item.
      b. Firm name, principal name, address, and telephone number.
      c. Scope.
      d. Date of beginning of warranty, bond, or service maintenance contract.
      e. Duration of warranty, bond, or service maintenance contract.
      f. Provide information for Owner's personnel:
         1. Proper procedure in case of failure.
         2. Instances affecting validity of warranty or bond.
      g. Subcontractor, name of responsible principal, address, and telephone number.

B. Form:
   1. Prepare in triplicate packets.
   2. Format:
      a. Size: 8-1/2" by 11"; punch sheets for standard three-ring binder. Fold larger sheets to fit into binders.
      b. Binders: Include in Operation and Maintenance Manuals.
      c. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
         1. Name of Subcontractor
         2. Title of project
         3. Name and address of local parts supplier and service organization.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017400

SECTION 017700 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 FINAL INSPECTION

A. When the Contractor Considers the Work Is Complete, Contractor Shall Submit Written Certification That:
   1. Contract Documents have been reviewed.
   2. Work has been inspected for compliance with Contract Documents.
   3. Work has been completed in accordance with Contract Documents.
   4. Equipment and systems have been tested in the presence of Owner's representative, are operational, and the instructional meeting is ready to be held.
   5. Work is completed and ready for final inspection.

B. Architect will make an inspection to verify the status of completion within 7 calendar days after receipt of such certification.

C. Should Architect consider that the work is incomplete or defective:
   1. Architect will promptly notify the Designer and Contractor in writing, listing the incomplete or defective work.
   2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the work is complete.
   3. Architect will re-inspect the work.

D. When Architect finds that the work is acceptable under the Contract Documents, the representative shall request the Contractor to make closeout submittals.

1.2 CLOSEOUT SUBMITTALS

A. Furnish three bound and indexed copies of an approved operation and maintenance instruction manual covering each item of equipment installed where applicable. These manuals shall provide complete instructions of the proper operation, use and periodic maintenance, together with the source of replacements and service for items covered.
   1. Operation and Maintenance Manuals: Contractor shall submit single loose leaf maintenance manual and with an index, for mechanical and electrical equipment, fixtures, finish hardware, equipment, Owner supplied equipment, finishes requiring special treatment, warranties and as otherwise required in specifications. Include a copy of approved shop drawings for these items.
   2. Format:
      a. Size: 8-1/2" x 11"; punch sheets for standard three-ring binder. Fold larger sheets to fit into binders.
      b. Binder: Commercial quality, three-ring, with durable and cleanable plastic covers. Size binder to contain all information in a single binder if possible.

c. Cover: Identify each packet with typed or printed title "Operations and Maintenance Manual." List:
- Title of Project
- Name of Subcontractor
- Name and Address of local parts supplier and service organization.

B. Record Drawings: Record actual construction on clean set of blackline drawings, suitable for scanning.
1. Depths of various elements of foundation in relation to pavement level.
2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
4. Field changes of dimension and detail.
5. Changes made by Change Order or Field Order.
6. Details not on original Contract Drawings.
7. Mark-ups on blacklines shall be made in black ink.

C. Inspection Reports: Subcontractor shall submit certificates from applicable local agencies indicating construction has been inspected as required by laws or ordinances and building is approved for occupancy.

D. Material Safety Data Sheets: Contractor shall furnish one complete copy for all hazardous substances used during construction.

E. Valve Tag Schedules: Contractor shall furnish two copies of schedules with close-out documents; mount one copy, framed under glass in Mechanical Room.

F. Contractor shall coordinate explanations, demonstrations and trial runs of equipment for Owner's designated personnel; complete such demonstrations in accordance with Owner's schedule.

G. Contractor shall wall mount schedules and drawings specified in Divisions 15 and 16, at approved locations, covered with plexi-glass permanently attached to substrate with screws.

1.3 OPERATING INSTRUCTIONS

A. Submit to the Owner’s delegated representative WRITTEN and ORAL instructions (by trained personnel) in the care, use, maintenance and operation for each product.

B. Instructions shall cover a one calendar year cycle of use. Issue instructions in accord with, and in addition to, the "Maintenance Manual".

C. Insert written operating instructions in "Maintenance Manual".

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017700

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 FINAL INSPECTION

A. When the Contractor Considers the Work Is Complete, Contractor Shall Submit Written Certification That:
   1. Contract Documents have been reviewed.
   2. Work has been inspected for compliance with Contract Documents.
   3. Work has been completed in accordance with Contract Documents.
   4. Equipment and systems have been tested in the presence of Owner's representative, are operational, and the instructional meeting is ready to be held.
   5. Work is completed and ready for final inspection.

B. Architect will make an inspection to verify the status of completion within 7 calendar days after receipt of such certification.

C. Should Architect consider that the work is incomplete or defective:
   1. Architect will promptly notify the Designer and Contractor in writing, listing the incomplete or defective work.
   2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the work is complete.
   3. Architect will re-inspect the work.

D. When Architect finds that the work is acceptable under the Contract Documents, the representative shall request the Contractor to make closeout submittals.

1.2 CLOSEOUT SUBMITTALS

A. Furnish three bound and indexed copies of an approved operation and maintenance instruction manual covering each item of equipment installed where applicable. These manuals shall provide complete instructions of the proper operation, use and periodic maintenance, together with the source of replacements and service for items covered.
   1. Operation and Maintenance Manuals: Contractor shall submit single loose leaf maintenance manual and with an index, for mechanical and electrical equipment, fixtures, finish hardware, equipment, Owner supplied equipment, finishes requiring special treatment, warranties and as otherwise required in specifications. Include a copy of approved shop drawings for these items.
   2. Format:
      a. Size: 8-1/2" x 11"; punch sheets for standard three-ring binder. Fold larger sheets to fit into binders.
      b. Binder: Commercial quality, three-ring, with durable and cleanable plastic covers. Size binder to contain all information in a single binder if possible.

c. Cover: Identify each packet with typed or printed title "Operations and Maintenance Manual." List:
- Title of Project
- Name of Subcontractor
- Name and Address of local parts supplier and service organization.

B. Record Drawings: Record actual construction on clean set of blackline drawings, suitable for scanning.
1. Depths of various elements of foundation in relation to pavement level.
2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
4. Field changes of dimension and detail.
5. Changes made by Change Order or Field Order.
6. Details not on original Contract Drawings.
7. Mark-ups on blacklines shall be made in black ink.

C. Inspection Reports: Subcontractor shall submit certificates from applicable local agencies indicating construction has been inspected as required by laws or ordinances and building is approved for occupancy.

D. Material Safety Data Sheets: Contractor shall furnish one complete copy for all hazardous substances used during construction.

E. Valve Tag Schedules: Contractor shall furnish two copies of schedules with close-out documents; mount one copy, framed under glass in Mechanical Room.

F. Contractor shall coordinate explanations, demonstrations and trial runs of equipment for Owner's designated personnel; complete such demonstrations in accordance with Owner's schedule.

G. Contractor shall wall mount schedules and drawings specified in Divisions 21, 22, 23 and 26, at approved locations, covered with plexi-glass permanently attached to substrate with screws.

1.3 OPERATING INSTRUCTIONS

A. Submit to the Owner’s delegated representative WRITTEN and ORAL instructions (by trained personnel) in the care, use, maintenance and operation for each product.

B. Instructions shall cover a one calendar year cycle of use. Issue instructions in accord with, and in addition to, the "Maintenance Manual".

C. Insert written operating instructions in "Maintenance Manual".

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. Provide selective demolition complete. Extent of selective demolition is as indicated on drawings and as specified herein.

B. This section includes:
   1. Demolition and partial removal of buildings and / or structures.
   2. Disconnecting, capping or sealing, and abandoning and / or removing site utilities.

C. Related sections specified elsewhere:
   1. Division 01 Section “Cutting and Patching”

1.2 DEFINITIONS

A. Definitions as follows:
   1. Remove: Remove and legally dispose of items except those indicated to be reinstalled, or to remain the Owner's property.
   2. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.3 SUBMITTALS

A. As specified in Division 01 Section Submittal Procedures.

B. Record drawings: Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions. As specified in Division 01 Section “Project Record Documents”.

1.4 QUALITY ASSURANCE

A. Coordinate schedule of demolition shutoff, capping, continuation of utility services, and other items that disturb the existing working Division 01Section “Project Coordination”.

B. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition work similar to that indicated for this Project.

C. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. General Contractor to assume responsibility of dust and noise control measures.

B. Owner may occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

C. Owner assumes no responsibility for actual condition of buildings to be selectively demolished.

D. Storage or sale of removed items or materials on-site will not be permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Except where noted otherwise, maintain possession of materials being demolished. Immediately remove from site.

PART 3 – EXECUTION

3.1 EXAMINATION / PREPARATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

C. Owner assumes no responsibility for actual condition of items or structure to be demolished,

D. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

E. Protections: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.

F. Provide protective measures and directional information signage as required to provide safe passage of Owner's personnel and general public to and from occupied portions of building.

G. Erect temporary covered passageways as required by authorities having jurisdiction.

H. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished, and adjacent facilities or work to remain.

I. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

J. Construct temporary insulated solid dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks if required.

K. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

L. Remove barriers and protections at completion of work.

M. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

3.2 DEMOLITION

A. Perform selective demolition work in a systematic manner.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

D. If unanticipated mechanical, electrical or structural elements which conflict demolition work are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange demolition schedule as necessary to continue overall job progress without delay.

E. Demolish and remove existing construction only to the extent required by new construction and as indicated

F. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

G. Utility Requirements: Locate, identify, shut off, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

1. Provide temporary services during interruption to existing utilities to remain, as acceptable to Owner and to governing authorities.

H. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

I. Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations, if applicable.

J. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

K. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

L. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Coordinate with Albertsons environmental remediation plan, if applicable.

M. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3.3 ADJUSTING AND CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

B. Restore exposed finishes of patched areas as indicated.

C. Disposal: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
1. Do not burn demolished materials.
2. Transport demolished materials off Owner's property and legally dispose of them.

3.4 PROTECTION

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

B. Maintain items to be removed and salvaged, removed and reinstalled, or existing to remain and protect them against damage during demolition operations.

END OF SECTION 024119

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Wood blocking and nailers.
   2. Wood furring.

1.3 DEFINITIONS

A. 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. RIS: Redwood Inspection Service.
   4. SPIB: The Southern Pine Inspection Bureau.
   5. WCLIB: West Coast Lumber Inspection Bureau.
   6. WWPA: Western Wood Products Association.

PART 2 - PRODUCTS

2.1 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

C. 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.

D. Use steel common 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. Drive nails snug but 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.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

END OF SECTION 061000

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
   1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Perimeter joints of exterior openings where indicated.
      b. Tile control and expansion joints.
      c. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
      d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      e. Other joints as indicated.
   2. Interior joints in the following horizontal traffic surfaces:
      a. Control and expansion joints in tile flooring.
      b. Other joints as indicated.

B. Related Sections include the following:
   1. Division 08 Section "Glazing" for glazing sealants.
   2. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   3. Divisions 21, 22, 23 and 26 for sealing of perimeter joints of plumbing, HVAC systems, automatic fire protection systems, telecommunication systems, and electrical systems.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in materials, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, shelf/pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Remove and replace materials, at no cost to Owner, that cannot be applied within their stated shelf life.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside 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.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation to ensure a weathertight installation.

PART 2 - PRODUCTS

2.1 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.

2.2 JOINT SEALANTS

A. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type S, Grade NS, Class 25; single component.
   1. Sonolastic NP-1; Sonneborn, Division of ChemRex Inc.
   2. Dymonic; Tremco, Inc.
   3. Sikaflex-1a; Sika Corporation, Inc.
   4. Dynatrol 1; Pecora Corporation.
   5. Vulkem 116; Tremco, Inc.
   6. Chem-Calk 900; Bostik Findley.

B. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
   1. Tremflex 834; Tremco, Inc.
   2. AC-20; Pecora Corporation.
   3. Chem-Calk 600; Bostik Findley.

C. Type 4 - Plumbing Fixture/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant, color selected by Architect.
   1. Sanitary SCS 1700; GE Silicones.
   2. 898 Silicone; Pecora Corporation.
   3. 786 MR Silicone; Dow Corning Corporation.
   4. Tremsil 200; Tremco, Inc.

2.3 JOINT-SEALANT BACKING

A. General: Provide sealant backings (backer rods) 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. Plastic Foam Joint Fillers (Backer Rods): Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

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.

2.4 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 concrete, masonry unglazed surfaces of ceramic tile, and similar 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.
   3. Remove laitance and form-release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other 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.

B. Joint Priming: Prime joint substrates, where indicated or 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. Installation of Sealant Backings (Backer Rods): Install sealant backings to comply with the following requirements:
   1. Install sealant backings of type indicated to provide support of 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.
      a. Do not leave gaps between ends of joint fillers.
      b. Do not stretch, twist, puncture, or tear joint fillers.
   2. Install bond-breaker tape behind sealants where sealant backings (backer rods) are not used between sealants and backs of joints.

D. Installation of Sealants: Install sealants using proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and 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.

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 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joints between Exterior Metal Frames and Adjacent Work (except masonry): Type 1; colors as selected.

B. Under Exterior Door Thresholds: Type 1.

C. Exterior Joints for Which No Other Sealant Type is Indicated: Type 1; colors as selected.

D. Concealed Interior Perimeter Joints of Exterior Openings: Type 1.

E. Exposed Interior Perimeter Joints of Exterior Openings: Type 1; colors as selected.

F. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls: Type 3; colors as selected.

G. Interior Joints for Which No Other Sealant is Indicated: Type 2; colors as selected.

END OF SECTION 079200

SECTION 081113 - 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 hollow-metal work.

B. Related Requirements:
1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Shop Drawings: Include the following:
1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Steelcraft; an Ingersoll-Rand company.

2.2 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: SDI A250.8, Level 1.
1. Physical Performance: Level C according to SDI A250.4.
2. Doors:
a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: cold-rolled steel sheet, minimum thickness of 0.032 inch.
d. Edge Construction: Full Flush.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
f. Core: Kraft-paper honeycomb, Polystyrene, Polyurethane, Polyisocyanurate, Mineral board, or Vertical steel stiffener.
3. Frames:
a. Materials: cold-rolled steel sheet, minimum thickness of 0.042 inch.
b. Construction: Knocked down, Slip-on drywall, Face welded.
4. Exposed Finish: Prime

2.3 FRAME ANCHORS

A. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, 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: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

2.5 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
   1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
   2. Top Edge Closures: Close top edges of doors with inverted closures or flush closures of same material as face sheets.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
   3. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Four anchors per jamb from 60 to 90 inches high.

b. Compression Type: Not less than two anchors in each frame.
c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

4. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
6. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers 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. Provide loose stops and moldings on inside of hollow-metal work.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   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. Install frames with removable stops located on secure side of opening.
      b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      c. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
   4. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
   5. 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.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Steel Doors:
      a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
      c. At Bottom of Door: **3/4 inch** plus or minus 1/32 inch.
      d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

D. Glazing: Comply with installation requirements in Section 088000 "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.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Exterior manual-swing entrance doors and door-frame units.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Glazing-to-glazing contact.
      e. Noise or vibration created by wind and by thermal and structural movements.
      f. Loosening or weakening of fasteners, attachments, and other components.
      g. Sealant failure.
      h. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
   1. Wind Loads:
      a. Basic Wind Speed: 85 mph.
   2. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
      a. Component Importancve Factor is 1.0.

D. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

H. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

I. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
      b. Low Exterior Ambient-Air Temperature: 0 deg F.
   3. Interior Ambient-Air Temperature: 75 deg F.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
   2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

B. Samples for Initial Selection: For units with factory-applied color finishes.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

E. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of aluminum-framed systems.
   2. Include design calculations.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Seismic Qualification Certificates: For aluminum-framed systems**,** accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

C. Welding certificates.

D. Preconstruction Test Reports: For sealant.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

F. Source quality-control reports.

G. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.

H. Field quality-control reports.

I. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Quality-Control Program for Structural-Sealant-Glazed System: Develop quality control program specifically for Project. Document quality-control procedures and verify results for aluminum-framed systems. Comply with ASTM C 1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.

E. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

F. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.
   1. Test a minimum five samples each of metal, glazing, and other material.
   2. Prepare samples using techniques and primers required for installed systems.
   3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

G. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

H. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.

I. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

J. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage through fixed glazing and framing areas.
      f. Failure of operating components.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Kawneer Company, Inc.: 451T frames with 350 Medium Entrances and Frames.
   2. Vistawall Architectural Products: Series 3000 poured and debridged Thermal Storefront System with 375 Medium Entrances and Frames.
   3. Aluminum-framed entrances and storefront systems specified in this Section and curtain wall system specified in Division 8 Section "Glazed Aluminum Curtain Wall" shall be from same manufacturer.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
   2. Glazing: Fixed, center-plane system.
   3. Provide thermally broken extruded aluminum sill flashing with end dams for storefronts.
   4. Provide thermally broken extruded aluminum subframes for exterior storefronts and entrance frames.
   5. Provide doors manufactured by storefront system manufacturer.
   6. Provide components having face width indicated on Drawings.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   2. Reinforce members as required to receive fastener threads.
   3. Do not use exposed fasteners, except for hardware application. For hardware application, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system or hardware being fastened, unless otherwise noted. Exposed fasteners shall be stainless steel.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Aluminum Break Metal: Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness, not less than 0.125-inch thick, to maintain a flat appearance without visible deflection.

G. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, extruded EPDM rubber gaskets, fabricated to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

C. Spacers and Setting Blocks: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

D. Provide framing system gaskets, sealants, and joint fillers recommended by manufacturer for joint type.

E. Sealants and Joint Fillers: Provide for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."

2.5 ENTRANCE DOOR SYSTEMS

A. Doors: Manufacturer's standard glazed doors, for manual and power-assisted swing operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3-1/2-inch nominal width, 10-inch high bottom rail, and 6-inch cross rail.
3. Glazing Stops and Gaskets: Manufacturer's heavy weight removable mullion with weatherstripping, finish to match frame.
    a. Provide nonremovable glazing stops on outside of exterior doors.

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide heavy-duty units in sizes, numbers, and types recommended by entrance system and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish, unless otherwise indicated. Provide specified manufacturers without substitution.
1. Opening-Force Requirements:
    a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.

B. Ball-Bearing Hinges: Stainless steel with nonremovable pins (NRP) at hinges exposed to outside of exterior doors and to nonsecured side of interior doors.
1. Quantities:
    a. For doors with heights up to 87 inches, provide 3 hinges per leaf.
    b. For doors with heights of greater than 87 and up to 120 inches, provide 4 hinges per leaf.

C. Weather Stripping: Manufacturer's standard replaceable components.

D. Weather Sweeps: Manufacturer's standard exterior door bottom sweep with concealed fasteners on mounting strip.

E. Thresholds: Raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch. Coordinate cutouts for operating hardware with anchors and jamb clips.
   1. Material: Aluminum, mill finish.

F. Balance of Hardware: See Division 8 Section "Door Hardware."

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing from interior.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Storefront Framing: Fabricate components for assembly using shear-block system.

F. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Doors: Reinforce doors as required for installing hardware.
   1. At exterior doors, provide weather sweeps applied to door bottoms and compression weather stripping at fixed stops.

H. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed and field-installed hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation. Install sills in one piece, full width of opening except where opening exceeds available manufactured lengths. Provide sealed metal

end dams at ends of sills. Sills shall turn up on backside to form pan, directing water to the exterior.

E. Secure subframes to opening framing. Caulk exterior perimeter with backer rod and sealant. Caulk around interior perimeter between frame and the air/vapor barrier with backer rod and sealant.

F. Install components plumb and true in alignment with established lines and grades, without warp or rack.

G. Install glazing as specified in Division 8 Section "Glazing."

H. Entrances: Install to produce smooth operation and tight fit at contact points.
1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
3. Install hardware furnished in Division 8 Section "Door Hardware."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation. Color of sealant to match aluminum finish.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 ADJUSTING AND CLEANING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.
1. Provide tight fit at contact points and weather stripping. Provide smooth operation and weathertight closure. Frame shall be free from distortion.

B. Remove excess sealant and glazing compounds and dirt from surfaces. Remove nonpermanent labels and clean surfaces.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures entrances and storefront systems are without damage or deterioration at time of Substantial Completion.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

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. Commercial door hardware for the following:
      a. Swinging doors.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section “Submittal Procedures”.
   1. Submittals for Sections 081113 and 087100 shall be made concurrently.

B. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
      a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.
      g. Door and frame sizes and materials.
      h. Provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Where a door is not included in the Door Hardware Schedule at end of Part 3, provide hardware scheduled for similar type opening and review with Architect.
   4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data,

Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

D. Keying Schedule: Coordinate hardware function with the Owner. Prepare keying schedule by or under the supervision of supplier, detailing Owner's final keying instructions for locks.

E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 01.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware 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. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:
   1. Comply with all applicable codes. Comply with Americans with Disabilities Act (ADA), as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
      c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
   2. NFPA 101: Comply with the following for means of egress doors:
      a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
      c. Thresholds: Not more than 1/2 inch high.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of operators.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

2.2 HINGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hinges:
      a. Hager Companies.
      b. McKinney Products Company; Div. of ESSEX Industries, Inc.
      c. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Standards: Comply with the following:
   1. Butts and Hinges: BHMA A156.1.
   2. Template Hinge Dimensions: BHMA A156.7.

C. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.
   3. Four Hinges: For doors with heights 91 to 120 inches.
   4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches) Standard Weight	Heavy Weight
40 and under by 1-3/4	4-1/2	0.134	0.180
Over 40 by 1-3/4	5	0.146	0.190

E. Hinge Weight: Unless otherwise indicated, provide the following:
   1. Entrance Doors: Heavy-weight hinges.
   2. Stair Doors: Heavy-weight hinges.
   3. Doors with Closers: Heavy-weight antifriction-bearing hinges.
   4. Interior Doors: Heavy-weight hinges.

F. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior Hinges: Stainless steel, with stainless-steel pin.
   2. Interior Hinges: Steel, with steel pin.

G. Hinge Options: Comply with the following:
   1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
      a. Outswinging exterior doors.
      b. Outswinging interior doors with locks.
   2. Corners: Square.
   3. Coordinate hinge requirements and reinforcement with aluminum door supplier.

H. Fasteners: Comply with the following:
   1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
   2. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

3. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mechanical Locks and Latches:
      a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.

B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA Grade 1; Series 1000.
   1. Sargent: Series 8200, Lever design LNB.

C. Auxiliary Locks: BHMA Grade 1, Sargent 4800 Series mortise deadlocks.

D. Lock Trim: Comply with the following:
   1. Lever: Forged or Cast.
   2. Escutcheon (Rose): Wrought, forged, or cast.

E. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
   1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
   2. Deadbolts: Minimum 1-inch bolt throw.

F. Backset: 2-3/4 inches, unless otherwise indicated.

2.4 CYLINDERS AND KEYING

A. Available Manufacturers:
   1. Cylinders: Sargent, to match existing facility standards.

B. Standards: Comply with the following:
   1. Cylinders: BHMA A156.5.

C. Cylinder Grade: BHMA Grade 1.
   1. Furnish cylinders for locksets, as well as the cylinders being used with exit devices.

D. Construction Keying: Comply with the following:
   1. Provide temporary cylinders and keys for use by the contractor during the construction period. Provide temporary cylinders for new exterior doors.
   2. Replace construction cores with permanent cores at completion of project.

E. Keying System: Prepare keying schedule with the Owner.
   1. Master Key System: Cylinders are operated by a change key, and a master key.

F. Keys: Provide nickel-silver keys complying with the following:
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE."

   2. Quantity: In addition to one extra blank key for each lock, provide the following:

a. Cylinder Change Keys: Three for each cylinder keyed differently; Six for each set keyed alike; Four for sets where only two cylinders are keyed alike.

2.5 STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated.

2.6 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Surface-Mounted Closers:
a. LCN Closers; an Ingersoll-Rand Company.
b. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.

B. Standards: Comply with the following:
1. Closers: BHMA A156.4.

C. Surface Closers: BHMA Grade 1, cast-iron body.
1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.
2. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.
3. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
4. Closer arms shall have a powder coating finish.
5. Provide drop, mounting plates where required.
6. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.
7. Door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.
8. Closers shall conform to all applicable code and law requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.
9. Models:

	LCN	Sargent
Exterior	4111S-CUSH	281 - CPS
	4111S-H-CUSH	281 - CPSH
Interior	4011	281 - 0
	4111	281 - P10

D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.7 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metal Protective Trim Units:
      a. Burns Manufacturing Incorporated.
      b. Don-Jo Mfg., Inc. .
      c. Rockwood Manufacturing Company.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:
   1. Stainless Steel: 0.050 inch thick; beveled top and 2 sides.

D. Fasteners: Provide manufacturer's oval head exposed fasteners for door trim units consisting of either machine or self-tapping screws, for installation in counter sunk holes.

E. Furnish protection plates sized 2 inches less than door width on push side by the following height:
   1. Kick Plates: 8 inches

2.8 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Glynn-Johnson; an Ingersoll-Rand Company.
   2. Hager Companies.
   3. Ives: H. B. Ives.
   4. Rixson-Firemark, Inc.; Div. of Yale Security Inc.
   5. Rockwood Manufacturing Company.

B. Standards: Comply with the following:
   1. Stops and Bumpers: BHMA A156.16.
   2. Mechanical Door Holders: BHMA A156.16.
   3. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1.
   1. Wall Stops: Convex with concealed mounting.
   2. Floor Stops: Dome stop, base thickness to accommodate flooring thickness.

D. Overhead Holder-Stop: BHMA A156.8.
   1. Rixon Checkmate Adjustable Standard Duty 10 Series, surface mount on push side, US32D, or US26D (626).

E. Wall Stops: For doors, unless floor or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

1. Where floor or wall stops are not appropriate, provide heavy duty overhead holders.
    a. Glynn-Johnson GJ90.
    b. Sargent 590.

F. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.9 DOOR GASKETING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Door Gasketing and Door Bottoms:
    a. National Guard Products, Inc.
    b. Pemko Manufacturing Co., Inc.
    c. Reese Enterprises, Inc.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

C. Weather-Strip Gasketing Models: Listed manufacturers with comparable models to the following:

Product	Pemko	Reese	NGP
Thresholds	as detailed		
Brush Seal	45062AP	970	A626A
Door Sweep	345AV	353	101AV
Smoke Seal	S88		5050

2.10 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. National Guard Products, Inc.
2. Pemko Manufacturing Co., Inc.
3. Reese Enterprises, Inc.
4. Zero International, Inc.

B. Standard: Comply with BHMA A156.21.

C. General: Extruded aluminum, depth as required for sill condition. Where thresholds extend out beyond face of frame, provide returned closed ends by miter cutting on a 45 degree angle and return to face of frame.

2.11 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and

BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Steel Machine or Wood Screws: For the following fire-rated applications:
      a. Mortise hinges to doors.
      b. Strike plates to frames.
      c. Closers to doors and frames.
   3. Spacers or Sex Bolts: For through bolting of hollow metal doors.
   4. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.12 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
   1. BHMA 626 (US26D): Satin chromium plated over nickel, over brass or bronze base metal.
   2. BHMA 630 (US32D): Satin stainless steel, over stainless-steel base metal.

E. With the exceptions of exit devices, door closers, plates, push bars, pulls, thresholds and weatherstripping, all hardware items shall be furnished in dull chrome finish 26D.
   1. Exceptions are as follows:

Exit Devices:	32D
Door Closers:	Sprayed Aluminum
Plates:	32D

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Exit devices shall be carefully installed so as to permit friction free operation of touch bar and lever. Latching mechanism shall also operate freely without friction or binding.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
   1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
   2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.7 DOOR HARDWARE SCHEDULE

HW1

Doors 100
Each Opening Shall Have: Door Closers w/Drop Plates, Offset Door Pulls, Cylinders
Balance of Hardware by Aluminum Door Supplier

HW2

Doors 101, 109
Each Leaf Shall Have: Hinges, Lockset (Function D), Door Stop, Silencers, Cylinder

HW3

Doors 103, 104, 105, 106
Each Leaf Shall Have: Hinges, Lockset (Function F), Door Closer, Kick Plate, Door Stop, Silencers

HW4

Door 107
Each Leaf Shall Have: Hinges, Lockset (Function A), Door Closer, Door Stop, Silencers, Cylinder
B107
END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Glazed entrances.
   3. Interior borrowed lites.
   4. Storefront framing.

B. Related Sections include the following:
   1. Division 08 Section "Hollow Metal Doors and Frames" for factory glazing of fire-rated wood doors with glazed openings.

1.3 DEFINITIONS

A. Manufacturers of Glass Products: 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.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Minimum glass thickness, nominally, is 6.0 mm (0.23 inch).

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch- wide interspace.
   4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
      a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
      b. Solar Heat Gain Coefficient: NFRC 200.
      c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 01 Section “Submittal Procedures”.

B. Product Data: For each glass product and glazing material indicated.

C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

D. Maintenance Data: For glass and other glazing materials to include in maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
   1. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, and for lites 9 sq. ft. or less in area, provide glazing products that comply with Category I or II materials.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations 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: GANA's "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. General: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: Five years from date of Substantial Completion.

D. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 MONOLITHIC GLASS PRODUCTS

A. Uncoated Annealed Float Glass: ASTM C 1036; Type I (transparent flat glass), Class 1 (clear), Quality q3 (glazing select); 6 mm (0.23 inch) thick minimum.

B. Safety Glass: ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1 (clear); Quality q3 (glazing select); conforming to ANSI Z97.1; 6 mm (0.23 inch) minimum thick.

2.3 INSULATING GLASS PRODUCTS

A. Insulating-Glass Units, General: Preassembled units consisting of organically sealed lites of glass separated by a dehydrated interspace, complying with ASTM E 774, and with other requirements specified elsewhere.
   1. For properties of individual glass lites making up units, refer to requirements specified in "Flat Glass Products" Article of this Section for types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.
   2. Provide fully tempered, coated float glass where safety glass is designated or required by code.
   3. Performance characteristics designated for coated insulating glass are nominal values based on manufacturer's published test data for units with lites 6.0 mm (0.23 inch) thick and nominal 1/2-inch dehydrated space between lites, unless otherwise indicated.
   4. U-values are expressed as Btu/hour x sq. ft. x degrees F.
   5. Edge Seal Material: Black color.
   6. Spacer Specifications: Manufacturer's standard spacer material and construction.

B. Clear, Solar Control Low-E Insulated Glass Units: Uncoated insulating glass units complying with ASTM E 773 and E 774; double pane with glass elastomer edge seal; outer panes of 6-mm

(0.23 inch) clear glass and inner panes of 6-mm (0.23 inch) solar control float glass; total unit thickness of 1 inch (25 mm) minimum.

1. PPG Solarban 60 insulating unit, low-e coating on the #3 surface.
    a. Kind FT (fully tempered) where required by code and where indicated.
2. Visible Light Transmittance: 70 percent.
3. Reflectance: 11 percent.
4. Shading Coefficient: 0.44.
5. Solar Heat Gain Coefficient: 0.38.
6. Winter U-Value: 0.29.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. EPDM, ASTM C 864.
2. Silicone, ASTM C 1115.
3. Thermoplastic polyolefin rubber, ASTM C 1115.
4. Any material indicated above.

2.5 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing 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.

1. Neutral-Curing Silicone Glazing Sealants:
    a. Products:
        1) Dow Corning Corporation; 791.
        2) Dow Corning Corporation; 795.
        3) GE Silicones; SilPruf NB SCS9000.
        4) GE Silicones; UltraPruf II SCS2900.
        5) Pecora Corporation; 865.
        6) Pecora Corporation; 895.
        7) Pecora Corporation; 898.
    b. Type and Grade: S (single component) and NS (nonsag).
    c. Class: 50.
    d. Use Related to Exposure: NT (nontraffic).

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; 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.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
   1. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 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.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze 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, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

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.

3.3 GLAZING, GENERAL

A. 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.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

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. Protect glass edges as follows:
1. Use a rolling block in rotating glass units to prevent damage to glass corners.
2. Do not impact glass with metal framing.
3. Use suction cups to shift glass units within openings. Do not raise or drift glass with a pry bar.
4. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications and standards, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
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.

H. 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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

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 just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. 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 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket 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. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. 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; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. 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.

END OF SECTION 088000

SECTION 092950 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Tile backing panels.
   3. Non-load-bearing steel framing.
   4. Interior suspension systems.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for concealed wood blocking in gypsum board assembly walls.
   2. Division 07 Section "Joint Sealants" for sealants not covered by work of this Section.
   3. Division 09 Section "Painting" for coordination/inspection requirements with painting contractor and primers applied to gypsum board surfaces.

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single source from a single manufacturer.

B. Source Limitations for Panel Products: Obtain each type of gypsum board and other panel products from a single source from a single manufacturer.

C. Source Limitations for Finishing Materials: Obtain finishing materials from either manufacturer supplying gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

C. Stack gypsum panels flat on leveled supports off floor or slab to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products 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.

D. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F for 48 hours before application and continuously after until dry. Do not exceed 95 deg F when using temporary heat sources.

E. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

1.8 COORDINATION

A. Coordinate installation of framing tracks needing to be attached to structural components prior to application of spray-applied fire-resistive materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 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: ASTM A 653, G40, hot-dip galvanized, unless otherwise indicated.

2.3 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Manufacturers:
   1. Clark Western Building Systems.
   2. Dale Industries, Inc. - Dale/Incor.
   3. Dietrich Industries, Inc.
   4. MarinoWare; Division of Ware Ind.
   5. National Gypsum Company.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0625-inch-diameter (8-gage) wire, or double strand of not less than 0.099-inch- diameter (12-gage) wire.

C. Hangers: As follows:
   1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter (8-gage).

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
   1. Depth: 2 inches.

E. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
   1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
      a. Minimum Base Metal Thickness: 0.0312 inch (22 gage).

F. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock, heavy-duty.
   1. Products:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation; 640-C Drywall Furring System.
      c. USG Interiors, Inc.; Drywall Suspension System.
      d. Provide comparable system where fire-rated ceilings are indicated.

2.4 STEEL PARTITION AND SOFFIT FRAMING

A. Manufacturers:
   1. Clark Western Building Systems.
   2. Dale Industries, Inc. - Dale/Incor.
   3. Dietrich Industries, Inc.
   4. MarinoWare; Division of Ware Ind.
   5. National Gypsum Company.

B. Steel Studs and Runners: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.027 inch (22gage) minimum, unless otherwise indicated.
      a. Provide studs with 0.0329 inch (20 gage) minimum thickness at the following locations:
         1) For 6 inch and greater framing.
         2) For framing over 12 feet high.
         3) Where indicated.

2. Depth: As indicated.
3. Maximum Allowable Deflection: Increase metal thickness where required to meet the following:
    a. Maximum Allowable Deflection for Drywall Assemblies: L/240 calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.
    b. Maximum Allowable Deflection for Tile Backing Panels: L/360 calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.

C. Deep-Leg Deflection Track: ASTM C 645 top runner with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.

D. Firestop Deflection Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide deflection track with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.
1. Product: Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base Metal Thickness: 0.0598 inch (16 gage), unless indicated otherwise.

F. Cold-Rolled Channel Bridging: 0.0538-inch (16 gage) minimum bare steel thickness, with minimum 1/2-inch- wide flange.
1. Depth: 1-1/2 inches.
2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.

G. Deflection Brackets:
1. Construction: Slotted galvanized steel angle with step bushing to prevent over tightening of fasteners.
2. Vertical Deflection: 1-1/2 inch total travel.
3. Product: VertiClip; Signature Industries, (919) 844-0789.
    a. Series: SL, SDL, SLB, and SLS as required by attachment condition.

H. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing members to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.5 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Manufacturers:
1. G-P Gypsum Corporation.
2. National Gypsum Company.
3. United States Gypsum Company.

2.6 INTERIOR GYPSUM WALLBOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X, GPDW:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.
   3. Location: All locations, except as otherwise noted.

C. Moisture- and Mold-Resistant Type, GPDW-MR: ASTM C 1396/C 1396M with moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Mold-Resistance: ASTM D3273, rating of 10.
   4. Face Sheets: 100 percent post-consumer recycled content.
   5. Location: Walls and ceilings of toilet rooms.
   6. Products:
      a. G-P Gypsum Corp.; Toughrock Mold-Guard Gypsum Board.
      b. National Gypsum Co.; Gold Bond Brand XP Gypsum Board.
      c. United States Gypsum Co.; Fiberock Aqua-Tough Interior Panels.

2.7 TILE BACKING PANELS

A. Moisture- and Mold-Resistant Type, GPDW-MR: ASTM C 1396/C 1396M with moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Mold-Resistance: ASTM D3273, rating of 10.
   4. Face Sheets: 100 percent post-consumer recycled content.
   5. Location: Where indicated.
   6. Products:
      a. G-P Gypsum Corp.; Toughrock Mold-Guard Gypsum Board.
      b. National Gypsum Co.; Gold Bond Brand XP Gypsum Board.
      c. United States Gypsum Co.; Fiberock Aqua-Tough Interior Panels.

2.8 TRIM ACCESSORIES

A. Interior Metal Trim: ASTM C 1047, galvanized steel.
   1. Shapes:
      a. Cornerbead: 1-1/4 inch x 1-1/4 inch external corner with 1/8-inch nose bead. Use at outside corners, unless otherwise indicated.
      b. LC-Bead (Casing): J-shaped casing with 1/16-inch nose bead ground, not less than 30 gage; exposed long flange receives joint compound; use at exposed panel edges.
      c. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Product: Fry Reglet Corp.; Reveal Channel Model DCS-625-50.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.

3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
4. Accessories: Provide end caps where trim terminates at door frames and other open locations.

2.9 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper reinforcing tape. Fiberglass tape not permitted.
2. Moisture- and Mold-Resistant Tile Backing Panels: As recommended by panel manufacturer.

C. Setting-Type Joint Compound: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.

D. Drying-Type Joint Compound: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
1. Ready-Mixed Formulation: Factory-mixed product.

E. Type of Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, 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 or drying-type, all-purpose compound.
   a. Use setting type compound only for gypsum board receiving tile finishes.
   b. Use setting type compound only for abuse-resistant and impact-resistant gypsum board.
   c. Surfacing epoxy and joint tape for wallboard covered by mat lay-up system specified in Division 09 Section " Special Coatings."
3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
   a. Use setting type compound only for gypsum board receiving tile finishes.
   b. Use setting type compound only for abuse-resistant and impact-resistant gypsum board.
   c. Surfacing epoxy for wallboard covered by mat lay-up system specified in Division 09 Section " Special Coatings."
4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
   a. Use setting type compound only for gypsum board receiving tile finishes.
   b. Use setting type compound only for abuse-resistant and impact-resistant gypsum board.
   c. Surfacing epoxy for wallboard covered by mat lay-up system specified in Division 09 Section " Special Coatings."
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

F. Joint Compound for Tile Backing Panels:
   1. Moisture- and Mold-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, topping compounds.

2.10 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Fastening gypsum board to steel members: Type S bugle head.
   2. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

B. Clean dust, dirt and debris from tracks, cavities, and concealed spaces before installation of panels.

C. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Post-Installation Inspection: Inspect walls for dents and imperfections, with Installer and painter present, prior to painting. Verify exposed joints are finished up to required heights (to above acoustical ceilings and walkable ceilings). Inspect wall again after primer and first coat of paint applied, with Installer and painter present. Installer shall touch-up as follows:
   1. Touch-up visible gypsum board imperfections before priming of walls.
   2. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.
   3. Joint compound touch-up shall be primed and painted and viewed for acceptability before final coat is applied.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 STEEL FRAMING INSTALLATION, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
   1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
   2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
      a. Allow for 3/4-inch deflection at floors and 1-1/2 inches at roofs.
      b. Install deflection track top runner or deflection brackets to attain lateral support and avoid axial loading.
      c. Install deflection firestop track top runner at fire-resistance-rated assemblies.
         1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend ceiling hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   3. Wire Hangers: Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.

4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Attach hangers to structural members.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck. Attach hangers to structural members.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit. Attach hangers to structural members.

D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

E. Sway-brace suspended steel framing with hangers used for support.

F. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.

G. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

H. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
3. Provide additional framing to support gypsum board on both sides of control joints.

D. Install steel studs and furring at the following spacings:
1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
2. Multilayer Construction: 16 inches o.c., unless otherwise indicated.

3. Sound Rated Partitions: Space studs 24 inches o.c. for sound rated partitions, unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
1. Attach both flanges to floor runner track with screws.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. 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.
1. Install two studs at each jamb, unless otherwise indicated.
2. 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.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above, even when partitions are not full height. Provide diagonal bracing at tall partitions to stop deflection and vibration of studs when doors are slammed shut.
4. Extend jamb studs one-piece full height.

G. 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.

H. Installation Tolerance: Framing members shall be within the following limits:
1. Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing, a total variation of 1/4 inch in 8 feet from a true plane.
2. Layout of Walls and Partitions: 1/4 inch from intended position.
3. Plates and Runners: 1/4 inch in 10 feet from a straight line.
4. Studs: 1/4 inch in 10 feet out of plumb, not cumulative.
5. Headers and Sills of Openings: 1/8 inch from level across width of opening.
6. Soffits: 1/4 inch in 10 feet from level straight line.
7. Spacing of Framing Members: Comply with requirements of ASTM C 754.

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216, except as specified otherwise.

B. Install acoustical insulation, where indicated, before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. 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.

E. 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.

F. Attachment to Steel Framing: Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.
   1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to commencement of work.
   2. Construct control joints to maintain fire rating of wall and ceiling construction.

I. Cover both faces of steel stud partition 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 beams, joists and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by beams, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant. Caulk smoke partitions with acoustical sealant on both sides of wall to prevent the passage of smoke. Run board to within 1/4 inch of floor slabs to provide full support of resilient base and resinous flooring base.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with casing bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
   1. Use fire-rated acoustical sealant for fire-rated walls.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
   1. Space screws a maximum of 12 inches o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

M. Remove screws that do not hit studs, supports, or blocking.

3.7 PANEL APPLICATION METHODS

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), 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 board.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Tile Backing Panels:
   1. Moisture- and Mold-Resistant Gypsum Backing Board: Install where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

3.8 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. Install corner bead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
   1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
   2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
   3. Install U-bead where indicated.

D. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect. Maintain fire rating of joints in fire rated construction

E. Aluminum Trim: Install in locations indicated on Drawings.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of corner bead, 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.
   1. Treatment of vertical and horizontal wallboard joints and screw heads that are located directly beneath the mat lay-up system with surfacing epoxy and fiberglass tape is specified in Division 09 Section “Special Coatings.”

B. Prefill open joints, beveled edges, and damaged surface areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints and to flanges of trim accessories, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 1: At ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
   2. Level 2: At ceiling plenum areas, concealed areas, and where indicated, for fire-resistance-rated assemblies, smoke assemblies and sound-rated assemblies.
   3. Level 2: Where panels are substrate for tile and where indicated.
   4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

E. Where Level 1 gypsum board finish is indicated, embed tape in joint compound. Surface shall be free of excess joint compound.

F. Where Level 2 gypsum board finish is indicated, fill fastener heads, embed tape in joint compound and apply thin coat of joint compound over all joints and interior angles.

G. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
   1. At tapered edge joints, draw compound down to a level plane, leaving a monolithic surface that is flush with paper face. Finish coat shall be feathered a minimum of 8 inches beyond both sides of center of joint tape.
   2. At end-to-end butt joints, draw compound down to minimize hump created by joint tape application. Finish coat shall be feathered a minimum of 16 inches beyond both sides of center of joint tape.
   3. End product shall be a surface that appears level without telegraphing joint locations as high spots when viewed down wall after painting.
   4. Finish board to within 1/4 inch of floor, providing full support for resilient wall base without telegraphing joint.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.
      f. Installation of above ceiling automatic fire suppression piping, including leak and pressure testing.
      g. Installation of ceiling support framing.

3.11 CLEANING

A. Promptly remove any residual joint compound from adjacent surfaces.

3.12 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 092950

SECTION 093100 - TILE

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. Porcelain tile.

B. Related Sections include the following:
   1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 09 Section "Gypsum Board Assemblies" for moisture- and mold-resistant tile backer board.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
   1. Waterproofing.
   2. Crack-suppression membrane.
   3. Metal edge strips.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
   1. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient and substrate temperatures and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
   1. Maintain temperatures at 50 deg F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for 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 PRODUCTS, GENERAL

A. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

B. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

C. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

2.3 TILE PRODUCTS

A. Porcelain Tile, PT1, PT2: Flat tile as follows:
   1. Composition: Porcelain.
   2. Face Size, PT1 & PT1A: Nominal 6-inches by 6-inches.
   3. Product: Crossville, Cotto Americana.
      a. Colors: As indicated on Materials Legend.

2.4 SETTING AND GROUTING MATERIALS

A. Manufacturer: Bostik, Trucolor, color as indicated on Materials Legend.

2.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
   1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Zinc alloy or stainless steel terrazzo strips, 1/8-inch wide at top edge with integral provision for anchorage to mortar bed or substrate unless otherwise indicated.
   1. Provide at tile to carpet locations and where indicated.
   2. Product: Schluter Systems L.P.; Schluter Schiene.

C. Metal Transition Strips: Stainless steel transition strip, ADA compliant, for transitioning from tile to lower profile floor covering; transition strip shall have integral provision for anchorage to mortar bed.
   1. Product: Reno-U; Schluter Systems L.P.

D. Control Joints (CJ): Control joints for porcelain tile, thermoplastic movement joint with opposing metal profiles.
   1. Product: Schluter DILEX-KS.

E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions, including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

B. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Check flatness of substrate by laser. Level floor to provide a base for thin set that allows for a smooth, flat floor without irregularities. Grinding high spots until substrate is acceptable to the flooring Installer is specified in Division 03 Section "Cast-in-Place Concrete."
   2. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
   3. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified to assure proper adhesion of mortar.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Lay tile in patterns indicated. When field conditions conflict with indicated pattern, notify Architect in writing prior to installation for review and approval of revisions.

D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile. Top setting of coved base is not permitted.

F. Tile shall lay flat and each edge flush with adjacent tile, free of tilting and skewed tile. Provide additional setting material to shim accent tiles that are thinner than field tiles so face is in same plane.

G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

H. Lay out tile wainscots to next full tile beyond dimensions indicated.

I. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate expansion joints in accordance with approved Shop Drawings.
   2. Space joints no greater than 36 feet apart, 16 feet apart at areas exposed to direct sunlight.
   3. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

J. Grout tile to comply with requirements of the following tile installation standards:
   1. For ceramic tile grouts (latex-portland cement grouts), comply with ANSI A108.10.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
   1. Turn membrane up walls as follows to keep water from traveling under partitions:
      a. Toilet Rooms with Tile Floors on Elevated Slabs: 2 inches minimum at perimeter walls of rooms.

B. Install crack-suppression membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
   1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
      a. Tile floors composed of tiles 8 by 8 inches or larger.

B. Joint Widths: Install tile on floors with the following joint widths:
   1. Porcelain Tile: 1/16 inch.

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet or other flooring that finishes flush with top of tile.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:
   1. Porcelain Tile: 1/16 inch.

3.7 CLEANING AND PROTECTING

A. Remove and replace material that is stained or otherwise damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

C. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 TILE INSTALLATION SCHEDULE

A. Porcelain Tile over Concrete Floors: Thin-set latex portland cement mortar tile setting bed over crack suppression membrane applied to saw cuts and random cracks, TCA F125.

B. Porcelain Tile on Moisture- and Mold-Resistant Tile Backer Board: Thin-set latex portland cement mortar tile setting bed, TCA W243.

END OF SECTION 093100

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

A. 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.
   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.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system from ICC-ES.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 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 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2 percent of quantity installed.
   4. Impact Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 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.

1.9 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.

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: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANELS, GENERAL

A. 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.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system 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.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. USG Interiors, Inc.; Subsidiary of USG Corporation.

2.4 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
2. Test Method for Ceiling Attenuation Class (CAC). Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Coating-Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273.

2.5 ACOUSTIC PANELS

A. Acoustic Panel: ACT-1.
   1. Size: 24 inches x 24 inches x 3/4-inch thick.
   2. Composition: Mineral wool fiber.
   3. Surface Finish: Factory-applied latex paint; white.
   4. Surface Texture: Fine texture.
   5. Edge: Square.
   6. CAC Range: 35.
   7. Fire Hazard Classification: Class A, 0 - 25 flame spread.
   8. Dimensional Stability: Sag resistant at high humidity.
   9. Anti-Mold and Anti-Mildew Treatment: Coating based, front and back.
   10. Product: Armstrong, No. 1732 Fine Fissured, square edge, or equal.
   11. Suspension System Type: A.
   12. Note: provide moisture-resistant ceiling tiles in restrooms.

2.6 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.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
   1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
   1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

2.7 METAL SUSPENSION SYSTEMS FOR ACOUSTICAL PANEL CEILINGS

A. Type A: Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.
   1. Structural Classification: Intermediate-duty system.
   2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
   3. Face Design: Flat, flush.
   4. Cap Material: Steel or aluminum cold-rolled sheet, as standard with manufacturer.
   5. Cap Finish: Painted white.
   6. Product: USG Interiors, Inc.; Donn DX/DXL Suspension System.

B. Radiused-edge trim:
   1. 12” high edge trim by USG Compass or Armstrong Axiom.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Hangers shall be single lengths of wire without splices; coordinate lengths in deep ceiling cavities.
2. 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.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches 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. Exposed pop rivets for grid alignment purposes shall not be permitted.

C. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.
   1. Each individual fixture and attachment with combined weight of 56 pounds or less shall have two 12-gage wire hangers attached at diagonal corners of the fixture. These wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 pounds shall be independently supported from the structure at all four corners.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
   2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels to run in the same direction.
   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 clips in Vestibules, at ACT-2, and at areas indicated, in areas required by authorities having jurisdiction; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
6. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - 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. Section Includes:
1. Resilient base.

B. Related Sections:
1. Section 096519 "Resilient Tile Flooring" for resilient floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) 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 F or more than 90 deg F.

1.5 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 resilient products 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. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johnsonite.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TV (vinyl, thermoplastic)
   2. Style: Cove (base with toe).

C. Minimum Thickness: 0.080 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Finish: Satin.

I. Colors and Patterns: As noted on Materials Legend.

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 resilient products and substrate conditions indicated.

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 resilient products.

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 for Resilient Stair Treads and Accessories: 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.
   4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent 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 resilient products until they are same temperature as the 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 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. 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.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
   1. Apply one coat.

E. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - 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. Section Includes:
   1. Rubber floor tile.
   2. Vinyl composition floor tile.

B. Related Sections:
   1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 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.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F 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.

PART 2 - PRODUCTS

2.1 RUBBER FLOOR TILE

A. Products: Subject to compliance with requirements, provide the following:
1. Ecore International, Inc., style: Everlast Roll. Contact: 515 450 2144 www.ecoreintl.com.

2.2 VINYL COMPOSITION FLOOR TILE

A. Products: Subject to compliance with requirements, provide the following:
1. Armstrong World Industries, Inc., Standard Excelon, Imperial Texture.

2.3 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.
1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. 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.

C. 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.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply one coat.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

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 modular carpet tile.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

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. Carpet Tile: Full-size units equal to percent of amount installed for each type indicated, but not less than 3 sq. yd.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.7 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Subject to compliance with requirements, provide the following:
   1. Patcraft, Dazzle Tile IO119, monolithic installation.

B. Color: 00512 Exquisite.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
   1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesives 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. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
   2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099123 - INTERIOR 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 interior substrates:
   1. Steel.
   2. Gypsum board.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

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. Paint: 5 percent, but not less than 1 gal. 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:
   1. Benjamin Moore & Co.
   2. Sherwin-Williams Company (The).
   Refer to Materials Legend in drawings for locations.

2.2 PAINT, GENERAL

A. Colors: As indicated in Materials Legend.

2.3 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.

2.4 METAL PRIMERS

A. Primer, Rust-Inhibitive, Water Based: MPI #107.

2.5 WATER-BASED PAINTS

A. Latex, Interior, Flat, (Gloss Level 1):[MPI #53.

B. Latex, Interior, Semi-Gloss, (Gloss Level 5): MPI #54.

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. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. 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 and recommendations in "MPI Manual" applicable to substrates indicated.

B. 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. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. 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.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. 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.
   1. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      h. Other items as directed by Architect.
   2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

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. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. 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.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:
   1. Latex over Alkyd Primer System:
      a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.

B. Gypsum Board Substrates:
   1. Latex System:
      a. Prime Coat: Primer sealer, latex, interior, MPI #50.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

END OF SECTION 099123

SECTION 104400 - FIRE-PROTECTION 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:
   1. Portable fire extinguishers.
   2. Mounting brackets for fire extinguishers.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguishers and fire-protection cabinets.
   1. Fire Extinguishers: Include rating and classification.

C. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 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 Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

D. Fire-Rated, Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

E. Fire Extinguisher Inspection: Prior to installation, professionally inspect all fire extinguishers in accordance with NFPA 10, "Portable Fire Extinguishers" and attach tag to the fire extinguisher verifying inspection and inspection date. Tag shall comply with the requirements of the local authority having jurisdiction. Tag with manufacturing date only is not acceptable.

1.5 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in

addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. JL Industries, Inc.
   2. Larsen's Manufacturing Company.
   3. Potter Roemer; Div. of Smith Industries, Inc.

B. Fire extinguishers and mounting brackets shall be from same manufacturer.

2.2 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Handles and Levers: Manufacturer's standard.
   2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

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 baked-enamel finish.
   1. Color: Black.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

C. Location: Provide for bracket mounted extinguishers in where indicated.

2.4 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

2.5 WALL SIGNAGE FOR EXTINGUISHERS

A. Wall Signage for Extinguishers: Provide 3-dimensional, projecting, photoluminescent signage for wall mounting; sign shall have a graphic of a fire extinguisher and an arrow pointing to fire extinguisher on each face of sign; and shall be roughly 6 inches high and project from wall approximately 5 inches. Provide with mounting hardware.
   1. Product: Fire Extinguisher Signs, Model S-4663; website: www.fireextinguishers.com.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
   1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

C. Identification: Apply decals at locations indicated.

D. Wall Signage: Mount where indicated in accordance with manufacturer's instructions.

END OF SECTION 104400

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

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. Sleeves.
   3. Escutcheons.
   4. Equipment installation requirements common to equipment sections.

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. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

D. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Mechanical sleeve seals.
   2. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 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 21 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 (3.2-mm) 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 (3.2 mm) 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.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Available Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      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.
   3. Pressure Plates: Carbon steel . Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) 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. PVC Pipe: ASTM D 1785, Schedule 40.

D. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 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 or white painted in finished spaces.

D. One-Piece, Floor-Plate Type: Cast-iron floor plate.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 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 free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
      c. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      d. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
      e. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

K. Sleeves are not required for core-drilled holes.

L. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

M. 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 (50 mm) 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 (6.4-mm) 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.

N. 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 "Joint Sealants" for materials.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 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. 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.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 for painting.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

B. Field Welding: Comply with AWS D1.1.

END OF SECTION 210500

SECTION 211000 - WATER-BASED FIRE-SUPPRESSION 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. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Sprinklers.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

1.4 SYSTE DESCRIPTIONS

A. Existing Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through an alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

B. The existing sprinkler entrance is located in the basement space under the Auto Parts Supply Store, and is accessible only from an exterior entrance on the east side of the plaza. The system consists of one riser with an alarm valve, which currently serves the Auto Parts Store, Mercy PT/OT, the vacant space previously occupied by TD Bank, and the new Anytime Fitness space. The existing 3” supply main enters the new space on the east wall approximately 45 feet from the front of the space. Existing sprinkler mains and branches may be reused providing the sizes can support the new system hydraulic demands. All sprinkler heads shall be replaced with new and located in all areas of the new space per NFPA 13. Sprinkler contractor shall verify existing conditions prior to the onset of any demolition. The existing service shall remain operational in adjacent spaces during construction. The sprinkler contractor shall notify all owners and the local fire department a minimum of three days prior to disruption of service. Provide an alarm valve, tamper and flow switch at existing main as it enters the new space. Install above acoustical tile ceiling in restroom for accessibility.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Available fire-hydrant flow test records indicate the following conditions:
    a. Date: August 2010
    b. Performed by: Portland Water District
    c. Location of Residual Fire Hydrant R:
    d. Residual Pressure at Residual Fire Hydrant R:
    e. Measured Flow at Residual Fire Hydrant R:

C. Sprinkler system design shall be approved by authorities having jurisdiction.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
    a. Office and Fitness Areas: Light Hazard.
    b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    c. General Storage Areas: Ordinary Hazard, Group 1.
    d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
3. Minimum Density for Automatic-Sprinkler Piping Design:
    a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
    b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.
4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:
    a. Light Hazard: 225 sq. ft. (20.9 sq. m).
    b. Ordinary Hazard Group I: 130 sq. ft. (12.1 sq. m).
6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
    a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Domestic water piping.
2. HVAC hydronic piping.
3. Items penetrating finished ceiling include the following:
    a. Lighting fixtures.
    b. Air outlets and inlets.

E. Qualification Data: For qualified Installer.

F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13R, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

G. Fire-hydrant flow test report.

H. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13R. Include "Contractor's Material and Test Certificate for Aboveground Piping."

I. Field quality-control reports.

J. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
      a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. 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.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13, "Installation of Sprinkler Systems."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Pipe ends may be factory or field formed to match joining method.

B. Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.

D. Cast-Iron Flanges: ASME 16.1, Class 125.

E. Grooved-Joint, Steel-Pipe Appurtenances:
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. Victaulic Company.
2. Pressure Rating: 175 psig (1200 kPa minimum).

F. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic and asbestos free.
1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.4 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:
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. Anvil International, Inc.
   b. National Fittings, Inc.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Sprinkler Inspector's Test Fittings:
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. Tyco Fire & Building Products LP.
   b. Victaulic Company.
   c. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Flexible, Sprinkler Hose Fittings:
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. FlexHead Industries, Inc.
   b. Viking.
2. Standard
   a. FM Approved for its intended use pursuant to FM 1637 Approval Standard for Flexible Sprinkler Hose with Threaded End Fittings.
   b. UL Listed for its intended use pursuant to UL 2443 Standard for Flexible Sprinkler Hose with Fittings for Fire Protection Service.
   c. Seismically qualified for use pursuant to ICC• ES AC• 156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
   a. Composition: 100% Type 304 Stainless Steel.
   b. Straight Hose Assembly Lengths: as required.
   c. Pressure Rating: 175 psig (1200 kPa) minimum.
   d. Size: Same as connected piping, for sprinkler. Materials: FlexHead Commercial Sprinkler Connections.
   e. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.
4. Ceiling Bracket:
   a. Composition: Type G90 Galvanized Steel.
   b. Type: Direct attachment type, having integrated snap• on clip ends positively attached to the ceiling using tamper-resistant screws.
   c. Flexible Hose Attachment: Removable hub type with set screw.

2.5 SPRINKLERS

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. Viking Corporation.
   2. Tyco Fire & Building Products LP.
   3. Globe Fire Sprinkler Corporation.
   4. Reliable Automatic Sprinkler Co., Inc.

B. General Requirements:
   1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
   2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.

C. Automatic Sprinklers with Heat-Responsive Element:
   1. Early-Suppression, Fast-Response Applications: UL 1767.
   2. Nonresidential Applications: UL 199.
   3. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
   4. Sprinkler head type:
      a. Concealed white pendant heads in finished spaces with gypsum board ceilings.
      b. Recessed type pendant, white finish in finished spaces with acoustical tile ceilings.
      c. Upright or pendant with bronze finish, in all unfinished spaces.

D. Sprinkler Finishes:
   1. Chrome plated.
   2. Bronze.
   3. Painted white.
   4. Antique Brass.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: White painted steel, two piece, with 1-inch (25-mm) vertical adjustment.
   2. Sidewall Mounting on Gypsum Board: Concealed head with flat white cover plate.
   3. Sidewall Mounting on Wood: Concealed head with flat Antique brass cover plate.
   4. 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. Viking Corporation.
      b. Tyco Fire & Building Products LP.
      c. Reliable Automatic Sprinkler Co., Inc.
      d. Victaulic Company.
   5. Standard: UL 199.

2.6 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated or white painted finish with set-screws.

C. Extended: One piece chrome plated for use in coolers and freezers.

2.7 SLEEVES

A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. PVC sleeves in first two paragraphs below may be prohibited by fire authorities having jurisdiction.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
1. Underdeck Clamp: Clamping ring with set-screws.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Coordinate with other trades.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Install sprinkler piping with drains for complete system drainage.

H. Install a sprinkler control valve where shown on drawings.

I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

J. Fill sprinkler system piping with water.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

3.4 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in the center of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

C. All heads in each room shall remain in a straight horizontal and vertical line for uniformity.

3.5 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:
   1. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated or white painted finish.
   2. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated or white painted finish.

3. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
4. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.6 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

F. Seal space outside of sleeves in concrete slabs and walls with grout.

G. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

H. Install sleeve materials according to the following applications:
1. Sleeves for Piping Passing through Gypsum-Board Partitions:
   a. PVC-pipe or Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 (DN 150).
   b. Galvanized-steel-sheetsleeves for pipes NPS 6 (DN 150) and larger.

2. Sleeves for Piping Passing through Interior Concrete Walls:
   a. PVC-pipe or Galvanized-steel-pipesleeves for pipes smaller than NPS 6 (DN 150).
   b. Galvanized-steel-sheetsleeves for pipes NPS 6 (DN 150) and larger.

I. 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 for firestop materials and installations in Division 07.

3.7 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section “Electrical Identification”.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Leak Test: After installation, charge systems 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. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the system

3.12 PIPING SCHEDULE

A. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight black-steel pipe with cutgrooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) shall be one of the following:
1. Standard-weight, black-steel pipe with cutgrooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Schedule 10black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 5 (DN 125) and larger, shall be one of the following:
   1. Standard-weight black-steel pipe with cutgrooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   2. Schedule 10black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Rooms without Ceilings: Upright sprinklers
   2. Rooms with Suspended Acoustical Tile Ceilings: Semi-Recessed sprinklers
   3. Hard ceilings (gypsum) and soffits: Concealed plate type sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Concealed Pendant Sprinklers: Rough brass, with factory painted white flat cover plate.
   2. Semi-Recessed Sprinklers: White heads, with white escutcheon.
   3. Upright Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

END OF SECTION 211000

SECTION 220500 - 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.

B. Related Sections
1. Division 23 Section "Common Work Results for HVAC."

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. Equipment installation requirements common to equipment sections.
8. Painting and finishing.
9. Concrete bases.
10. Supports and anchorages.

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. 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.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Mechanical sleeve seals.
   3. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.8 PERMITS

A. Obtain Plumbing Permit and pay fee. Fee shall be included in the filed sub-bid.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
   2. 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. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Solvent Cements for Joining Plastic Piping:
   1. CPVC Piping: ASTM F 493.
   2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

D. 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. Co.
      b. Dresser Industries, Inc.; DMD Div.
      c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
      d. JCM Industries.
      e. Smith-Blair, Inc.
      f. Viking Johnson.
   2. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
   3. 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 Div.

E. Flexible Transition Couplings for Underground Nonpressure 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. Co.
      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 (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
   1. Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Eclipse, Inc.
      d. Epco Sales, Inc.
      e. Hart Industries, International, Inc.
      f. Watts Industries, Inc.; Water Products Div.
      g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
   1. Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Epco Sales, Inc.
      d. Watts Industries, Inc.; Water Products Div.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
   1. Available Manufacturers:
      a. Calpico, Inc.
      b. Lochinvar Corp.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
   1. Available Manufacturers:
      a. Perfection Corp.
      b. Precision Plumbing Products, Inc.
      c. Sioux Chief Manufacturing Co., Inc.
      d. Victaulic Co. of America.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) 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. PVC Pipe: ASTM D 1785, Schedule 40.

2.7 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, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

PART 3 - EXECUTION

3.1 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 within 18” of the ceiling 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. Select system components with pressure rating equal to or greater than system operating pressure.

L. 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. 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 Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

M. Sleeves are not required for core-drilled holes.

N. 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 (50 mm) 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 (6.4-mm) 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.
         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.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) 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.

P. 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 "Joint Sealants" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 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.

3.3 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.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Section "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.7 ACCESS PANELS

A. Access panels required for items furnished under Division 21 shall be provided under this Division.

B. Access panels shall be standard panels, 12 in. x 16 in. (305 mm x 406 mm) minimum unless indicated otherwise. Panels installed in areas of high moisture concentration, such as locker rooms, shall be fabricated of paintable stainless steel or aluminum for corrosion resistance. Access panels in fire-rated construction shall have the same UL rating as the building assembly in which they are installed.

C. Provide access panels in building construction where required for access to control valves, tempering valves and other related items."

END OF SECTION 220500

SECTION 220516 - EXPANSION FITTINGS AND LOOPS 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. Metal-bellows expansion joints.
2. Rubber expansion joints.
3. Flexible-hose expansion joints.
4. Pipe bends and loops.
5. Alignment guides and anchors.

1.3 DEFINITIONS

A. BR: Butyl rubber.

B. Buna-N: Nitrile rubber.

C. CR: Chlorosulfonated polyethylene synthetic rubber.

D. CSM: Chlorosulfonyl-polyethylene rubber.

E. EPDM: Ethylene-propylene-diene terpolymer rubber.

F. NR: Natural rubber.

1.4 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.

B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.

4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Welding certificates.

D. Product Certificates: For each type of pipe expansion joint, signed by product manufacturer.

E. Maintenance Data: For pipe expansion joints to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Flexible-Hose Expansion Joints: Manufactured assembly with two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex, Inc. or comparable product by one of the following:
a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Metraflex, Inc.
3. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder-joint end connections.
a. NPS 2 (DN 50) and Smaller: Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.

2.2 ALIGNMENT GUIDES

A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex, Inc. or comparable product by one of the following:
a. Flex-Hose Co., Inc.
b. Flexicraft Industries.

2.3 MATERIALS FOR ANCHORS

A. Steel Shapes and Plates: ASTM A 36/A 36M.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
   1. Stud: Threaded, zinc-coated carbon steel.
   2. Expansion Plug: Zinc-coated steel.
   3. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

B. Install expansion joints of sizes matching size of piping in which they are installed.

C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.2 PIPE BEND AND LOOP INSTALLATION

A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Attach pipe bends and loops to anchors.
   1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.3 ALIGNMENT-GUIDE INSTALLATION

A. Install guides on piping adjoining pipe expansion fittings and loops.

B. Attach guides to pipe and secure to building structure.

3.4 ANCHOR INSTALLATION

A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.

C. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.

END OF SECTION 220516

SECTION 220523 - 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. Section Includes:
   1. Bronze ball valves.
   2. Bronze swing check valves.

B. Related Sections:
   1. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.1 for power piping valves.
   3. ASME B31.9 for building services piping valves.

C. 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 ball and plug valves open to minimize exposure of functional surfaces.

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.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
   1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
   1. Solder Joint: With sockets according to ASME B16.18.
   2. Threaded: With threads according to ASME B1.20.1.

F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
   1. Manufacturers: Subject to compliance with requirements :
      a. Conbraco Industries, Inc.; Apollo Valves.
      b. Milwaukee Valve Company.
      c. NIBCO INC.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig (1035 kPa).
      c. CWP Rating: 600 psig (4140 kPa).
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.

h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, :
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, :
a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Zy-Tech Global Industries, Inc.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

C. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, :
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. 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.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball valves.
2. Throttling Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, bronze with bronze trim.
   3. Bronze Swing Check Valves: Class 150, bronze disc.

END OF SECTION 220523

SECTION 220529 - 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.

B. Trapeze pipe hangers.

C. Related Sections include the following:
   1. Division 21 for pipe hangers for fire-suppression piping.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. 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. Available Manufacturers:
   1. B-Line Systems, Inc.; a division of Cooper Industries.
   2. Carpenter & Paterson, Inc.
   3. ERICO/Michigan Hanger Co.
   4. Grinnell Corp.

C. Padded Hangers: Hanger with fiberglass or other 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. Available Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Power-Strut Div.; Tyco International, Ltd.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

2.5 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. Available Manufacturers:
1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

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 noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. 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.

G. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).

H. 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.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
   2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   3. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   4. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. 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. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 for plumbing fixtures.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. 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.

H. 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. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
   2. 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.
   3. 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 (305 mm) long and 0.048 inch (1.22 mm) thick.
   4. Insert Material: Length at least as long as protective shield.
   5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

3.4 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.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions 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. 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, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 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.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm).

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid 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 (38 mm) high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
   1. Tag Material: Brass, 0.032-inch (0.8-mm 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.

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. 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 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

B. Pipe Label Color Schedule:

1. Domestic Cold Water Piping:
   a. Background Color: Green.
   b. Letter Color: White.
2. Domestic Hot Water, and Hot Water Return Piping:
   a. Background Color: Yellow.
   b. Letter Color: Black.
3. 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: 1-1/2 inches (38 mm), round.
      b. Hot Water: 1-1/2 inches (38 mm), round.
      c. Low-Pressure Gas: 1-1/2 inches (38 mm), round.
      d. High-Pressure Gas: 1-1/2 inches (38 mm), round.
   2. Valve-Tag Color:
      a. Cold Water: Natural.
      b. Hot Water: Natural.
      c. Gas: Natural.

3.5 CEILING VALVE MARKERS (TACKS)

A. Install ceiling tacks in suspended ceiling tiles to identify all plumbing valves.

B. Valve-Tack Application:
   1. Valve tack size and shape: Round, 7/8" (22 mm) diameter, ½" point, green color.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220700 - 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. Calcium silicate.
      b. Cellular glass.
      c. Flexible elastomeric.
      d. Mineral fiber.
   2. Insulating cements.
   3. Adhesives.
   4. Mastics.
   5. Lagging adhesives.
   6. Sealants.
   7. Factory-applied jackets.
   8. Field-applied fabric-reinforcing mesh.
   9. Field-applied cloths.
   10. Field-applied jackets.
   11. Tapes.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.
   8. Detail field application for each equipment type.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. 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 "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.

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. Calcium Silicate:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Industrial Insulation Group (The); Thermo-12 Gold.
   2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cell-U-Foam Corporation; Ultra-CUF.
      b. Pittsburgh Corning Corporation; Foamglas Super K.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   6. Preformed Pipe Insulation with Factory-Applied: Comply with ASTM C 552, Type II, Class 2.
   7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Aeroflex USA Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. 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.; Duct Wrap.
      b. Johns Manville; Microlite.
      c. Knauf Insulation; Duct Wrap.
      d. Manson Insulation Inc.; Alley Wrap.
      e. Owens Corning; All-Service Duct Wrap.

J. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Johns Manville; HTB 23 Spin-Glas.
    b. Owens Corning; High Temperature Flexible Batt Insulations.

K. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Johns Manville; Micro-Lok.
    b. Knauf Insulation; 1000(Pipe Insulation.
    c. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F (454 deg C) 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.

L. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid 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. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) 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. 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. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.

C. 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. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Childers Products, Division of ITW; CP-97.
    b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
    c. Marathon Industries, Inc.; 290.
    d. Mon-Eco Industries, Inc.; 22-30.
    e. Vimasco Corporation; 760.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D.

C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Childers Products, Division of ITW; CP-96.
    b. Foster Products Corporation, H. B. Fuller Company; 81-33.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Aeroflex USA Inc.; Aeroseal.
    b. Armacell LCC; 520 Adhesive.
    c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    d. RBX Corporation; Rubatex Contact Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. 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.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. 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.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. 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. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 WALL THIMBLE

A. Wall Thimble: GT Exhaust Systems, Inc. (ph:402-323-7272 or 800-775-2466) Model #20-B-350-P. Coordinate with existing width of exterior wall. See detail B2 on drawing P00.1.

2.5 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; Encacel.
b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
c. Marathon Industries, Inc.; 570.
d. Mon-Eco Industries, Inc.; 55-70.

e. Insert manufacturer's name; product name or designation.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.6 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 deg F (Minus 46 to plus 82 deg C).
4. Color: White.

2.7 SEALANTS

A. Joint Sealants:
1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

B. FSK and Metal Jacket Flashing Sealants:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-76-8.
      b. Foster Products Corporation, H. B. Fuller Company; 95-44.
      c. Marathon Industries, Inc.; 405.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Vimasco Corporation; 750.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Fire- and water-resistant, flexible, elastomeric sealant.
   4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
   5. Color: Aluminum.
   6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

D. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Manville; Zeston.
      b. Proto PVC Corporation; LoSmoke.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White.
   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.8 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 (75 mm).
   3. Thickness: 11.5 mils (0.29 mm).
   4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
      b. Compac Corp.; 110 and 111.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.

d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.
2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.
2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

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, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm)] 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 (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
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 for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 CALCIUM SILICATE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
   4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
   3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   2. Install insulation to flanges as specified for flange insulation application.
   3. Finish valve and specialty insulation same as pipe insulation.

3.7 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
   4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs 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 cut sections of cellular-glass block insulation of same thickness as pipe insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of cellular-glass insulation to valve body.
   2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 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 (150 mm) 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 (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   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.

E. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

F. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.10 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other 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.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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(s) 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.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

3.13 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.

3.14 PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS ½ and NPS ¾ : Insulation shall be one of the following:
      a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   2. NPS 1 (DN 25) and NPS 1-1/4 (DN 32): Insulation shall be one of the following:
      a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   3. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1/2 inch (13 mm) thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot Water:
1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
2. NPS 1-1/4 (DN 32) : Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.
3. NPS 1-1/2 (DN 40) and NPS 2 (DN 50) : Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.
4. NPS 2-1/2 (DN 63): Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inch (50 mm) thick.

C. Concealed Storm Drainage Piping:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
c. Mineral-Fiber Blanket Insulation.

D. Exposed Storm Drainage Piping:
1. All Pipe Sizes: Insulation shall be the following:
a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. 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. Pre-molded closed cell urethane, white color, PV Sanitary Waste Piping.

END OF SECTION 220700

SECTION 221116 - 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. Section Includes:
   1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
   2. Escutcheons.
   3. Sleeves and sleeve seals.

B. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.4 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
   2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
   1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
   2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
   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.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1) Elkhart Products Corporation; Industrial Division.
   2) NIBCO INC.
b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
c. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

C. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Existing domestic water entrance piping, located in a mechanical room behind the space previously occupied by TD Bank, and accessible only from the rear of the plaza. The existing service shall be reused for new domestic water service to Anytime Fitness space. Equipment to be reused shall include, but not limited to, reduced pressure backflow prevention devices and isolation valves. Provide a new water meter, type of which is acceptable with Portland Water District. Attach new labels and equipment tags on existing piping to be reused. Existing 1” cold water piping shall be reused from the mechanical room, through the adjacent unoccupied space, to 12” inside the new space. See drawings for more information.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.

D. Install domestic water piping level and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. 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.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping adjacent to equipment and specialties to allow service and maintenance.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. 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 valves for piping NPS 2 (DN 50) and smaller.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22.
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
   2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

3.5 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 existing water piping within the building.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

3.6 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for 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, cast brass with polished chrome-plated finish.

C. Escutcheons for Existing Piping:
   1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
   2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
   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 one day 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. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
   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 a 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 (345 kPa) 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 for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

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 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 domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures 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 (50 mg/L) 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 (200 mg/L) 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.

3.11 PIPING SCHEDULE

A. Domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) ; copper push-on-joint fittings; and push-on joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119 - 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. Temperature mixing valves.
   3. Drain valves.
   4. Trap-seal primer.

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. Field quality-control test reports.

C. 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 Co.
b. FEBCO; SPX Valves & Controls.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Plumbing Products Group; Wilkins Div.

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: Rough bronze.

2.2 TEMPERATURE MIXING VALVE TMV-1:

A. MXV-1: Master Mixing Valve for 120 degree loop.
1. Basis-of-Design Product: Subject to compliance with requirements, Powers #SH1432-HL single-valve, hi-low master, or a comparable product by one of the following:
a. Powers
b. Leonard
2. Description
a. Wall Mounted in mechanical room in sub-basement.
b. Inlet: 1 ½" diameter.
c. Outlet: 2" diameter.
d. Finish: Rough brass.
e. Strainer: Union angle strainer.
f. Checkstops: Integral.

2.3 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 (2760-kPa) 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.

2.4 TRAP-SEAL PRIMER VALVES

A. TP-1: Flow Through-Type, Trap-Seal Primer:
1. Basis-of-Design Product: Watts Series A200. Subject to compliance with requirements, provide a comparable product by one of the following:
a. PPP Inc.
b. Sioux Chief Manufacturing Company, Inc.
c. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) maximum, 25 psig minimum.
4. Number of Ports: One.
5. Type: Flow Through.

6. Inlet and Outlet Connections: NPS 1/2 PEX.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. 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.

C. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

D. 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

E. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system 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 "Grounding and Bonding."

C. Connect wiring according to Division 26.

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. Primary, thermostatic, water mixing valves.
   2. Trap-seal primer systems.

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 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 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 sanitary waste and vent piping within the building including the vent above the roof.
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

B. Inspect and clean existing sanitary waste piping prior to making any connections to new system piping. Verify that the condition of piping and slope is adequate for proper drainage for new fixtures. If existing piping is found to be acceptable based upon the criteria above, it may be reused.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PVC: Polyvinyl chloride plastic.

C. RePVC: Polyvinyl chloride plastic with recycled content.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated: 10-foot head of water 30 kPa or 5 psi.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. 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. All cast iron piping and fittings shall be marked with the collective trademark of the Cast Iron Sanitary Pipe Institute (CISPS) and be listed by NSF International.

C. 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.

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. 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 PIPE AND FITTINGS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
   1. Gaskets: ASTM C 564, rubber.
   2. Cast iron conforming to ANSI A112.51, with size, weight and manufacturer’s name on each length and fitting and shall conform to ASTM Standard Specifications. Joints shall be Bell and Spigot.

B. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
   1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
   2. Solvent Cement and Adhesive Primer:
      a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. RePVC Pipe: ASTM F 1760, solid-wall drain, waste, and vent.
   1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
   2. Solvent Cement and Adhesive Primer:
      a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Sanitary waste and vent piping shall be one of the following:
   1. Service class, cast-iron sanitary pipe and fittings; gaskets; and gasketed joints.
   2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   3. Solid-wall RePVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "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 wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

E. Make changes in direction for sanitary 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.

F. 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.

G. Install sanitary waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
   1. Horizontal Sanitary Drainage Piping: ¼” per foot downward in direction of flow.
   2. Vent Piping: 1/8” per foot down toward vertical fixture vent or toward vent stack.

H. Install PVC AND REPVC sanitary and waste drainage and vent piping according to ASTM D 2665.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. PVC AND RePVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. 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.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (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.

3.7 CLEANING

A. Clean entire existing sanitary waste system prior to performing new work.

B. Clean interior of piping. Remove dirt and debris as work progresses.

C. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

D. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 - 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. Cleanouts.
   2. Floor Drains.

B. Related Sections include the following:
   1. Division 22 Section "Plumbing Fixtures".

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Metal Floor Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
   3. Size: Same as connected branch.
   4. Type: Threaded, adjustable housing.
   5. Body or Ferrule: Cast iron.
   6. Clamping Device: Not required.
   7. Outlet Connection: Inside calk.
   8. Closure: Plastic plug.
   9. Adjustable Housing Material: Cast iron with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   11. Frame and Cover Shape: Round.
   12. Top Loading Classification: Heavy Duty.
   13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
   14. Standard: ASME A112.3.1.
   15. Size: Same as connected branch.
   16. Unfinished concrete floors: Model CO-200-R
   17. Carpeting: Model CO-200-RC.
   18. Resilient floor tile: Model CO-200-TS.
   19. Ceramic/Terrazzo tile: Model CO-200-US.

B. Cast-Iron Wall Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts CO-450-RD or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M. Include wall access.
   3. Size: Same as connected drainage piping.
   4. Body: Hubless, cast-iron soil pipe test as required to match connected piping.
   5. Closure: Countersunk, drilled-and-threaded plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
   7. Wall Access: Round, flat, stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Floor Drains
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. FD-1: FD-100-A, 2” ho hub outlet, epoxy coated cast iron body with anchor flange, reversible clamping collar, adjustable 7” round nickel bronze strainer and ½” trap primer connection.
   3. Standard: ASME A112.6.3.
   4. Anchor Flange: Required.
   5. Outlet: Bottom.
   6. Trap Material: Same material as connected piping.
   7. Trap Pattern: Standard P-trap.
   8. Trap Features: Trap-seal primer valve drain connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for all piping.
   4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 223300 - DOMESTIC WATER HEATER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Gas Fired On Demand Water Heater
   2. Master Mixing Valve

1.2 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

D. Warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE/IESNA-90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. 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.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Faulty operation of controls.
      b. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Period(s): From date of Substantial Completion:
      a. Water Heaters: One year.
         1) Five year limited warranty on heat exchanger.

PART 2 - PRODUCTS

2.1 WATER HEATER

A. WH-1: Gas Fired On Demand Water Heater.
   1. Basis-of-Design Product: Subject to compliance with requirements, AO Smith ATIO910-N or a comparable product by one of the following::
      a. Rheem
      b. Bosch
      c. Eemax
   2. Description
      a. Flow Rate: 7.1 GPM at 90 degree F temperature rise.
      b. Inlet: 1 ¼" diameter.
      c. Outlet: 1 ½" diameter.
      d. Vent: 4" diameter.

2.2 TEMPERING VALVES

A. MXV-1: Master Mixing Valve for 120 degree loop.
   1. Basis-of-Design Product: Subject to compliance with requirements, Powers #SH1432-13 single-valve, hi-low master, or a comparable product by one of the following:
      a. Powers
      b. Leonard
   2. Description
      a. Wall Mounted in mechanical room.
      b. Inlet: 1 ¼" diameter.
      c. Outlet: 1 ½" diameter.
      d. Finish: Rough brass.
      e. Strainer: Union angle strainer.
      f. Checkstops

PART 3 - EXECUTION

A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:
   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.

END OF SECTION 223300

SECTION 224000 - 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 conventional plumbing fixtures and related components:
   1. Faucets for lavatories and showers.
   2. Toilet seats.
   3. Fixture supports.
   4. Water closets.
   5. Lavatories.

B. Related Sections include the following:
   1. Division 10.
   2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
   3. Division 22 Section "Drinking Fountains and Water Coolers."

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

C. FRP: Fiberglass-reinforced plastic.

D. PVC: Polyvinyl chloride plastic.

E. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
   1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
   2. Plastic Bathtubs: ANSI Z124.1.
   3. Plastic Lavatories: ANSI Z124.3.
   4. Plastic Mop-Service Basins: ANSI Z124.6.
   5. Stainless-Steel Residential Sinks: ASME A112.19.3.
   6. Vitreous-China Fixtures: ASME A112.19.2M.

G. Comply with the following applicable standards and other requirements specified for sink faucets:
   1. Faucets: ASME A112.18.1.
   2. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
   3. NSF Potable-Water Materials: NSF 61.
   4. Pipe Threads: ASME B1.20.1.
   5. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
   6. Supply Fittings: ASME A112.18.1.
   7. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for shower faucets:
   1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
   2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
   3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
   4. Faucets: ASME A112.18.1.
   5. Hand-Held Showers: ASSE 1014.

6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Brass Waste Fittings: ASME A112.18.2.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period for Commercial Applications: Three year(s) from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 2 of each type.
4. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets: L-1, mounted on solid surface by others.
1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard Model Selectronic electronic proximity lavatory faucet, or a comparable product by one of the following manufacturers:
a. Kohler
b. TOTO
2. Description: ADA compliant, electronic faucet with proximity operation.
a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 0.5 GPM
d. Mounting: Faucet deck mounted.
e. Inlet(s): Insulated NPS 1/2 (DN 15).
f. Spout: Rigid type.
g. Operation: Proximity sensor
h. Power Source: Lithium battery.
i. Drain: Grid.
j. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), cast-brass P-trap; NPS 1-1/2 (DN 40) tubular brass waste to wall; and wall escutcheon, uninsulated piping located in shroud.

2.2 SHOWER FAUCETS

A. Shower Faucets: SH-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard Flo-Wise commercial shower system model 1662.211, or a comparable product by one of the following:
a. Powers
b. Kohler Co.
c. Leonard Valve Company.
d. Symmons
e. Watts Industries Co.
f. Zurn Plumbing Products Group;
2. Description: ADA compliant, Single-handle Pressure Balancing Valve.
a. Body Material: Solid brass valve with integral check stops.
b. Finish: Polished chrome plate metallic cover plate and handle.
c. Flow Rate: 1.5 gpm.
d. Temperature Limit Stop: Adjustable, factory set to 110 degrees.
e. Supply Connections: NPS 1/2 (DN 15).
f. Shower Head: Low flow hand held.
g. Glide Rail: 36”.
h. Hose: 59” Metal

2.3 MOP RECEPTOR FAUCETS

A. Mop Receptor Faucets: MR-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard Model 8344.012 or a comparable product by one of the following:

a. Chicago Faucet
b. Moen, Inc.
c. Zurn Plumbing Products Group; Commercial Brass Operation.

Select from list below for general-duty, solid-brass faucets.

2. Description: ADA compliant, wall mounted utility faucet with vacuum breaker.
   a. Body Material: General-duty, solid brass.
   b. Finish: Rough Chrome.
   c. Atmospheric vacuum breaker spout with pail hook and wall brace.
   d. Hose threaded outlet.
   e. Lever handles.
   f. Integral supply stops
   g. Install with additional check valves in hot and cold supply piping.

2.4 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
   2. Josam Company.
   3. MIFAB Manufacturing Inc.
   4. Smith, Jay R. Mfg. Co.
   5. Zurn Plumbing Products Group; Specification Drainage Operation.

2.5 WATER CLOSETS

A. Water Closet, WC-1:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard Model 28886.216, or a comparable product by one of the following:
      a. TOTO
      b. Kohler Co.
   2. Description: elongated high efficiency floor mounted dual flush toilet, 1.6 gpf/1.0 gpf, Accessible, vitreous-china fixture.
      a. Supply: NPS 1/2”
      b. Bowl Type: Elongated with high efficiency siphon action bowl with direct fed jet.
      c. Design Consumption: Dual Flush, 1.6 gal./flush full flush and 1.0 partial flush
      d. Color: White.
      e. Seat: 5901.110 elongated, open front, with everclean surface.

2.6 LAVATORIES

A. Lavatory L-1:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide American Standard, model 0145.001 wall hung vitreous china with 0059.020 shroud, contemporary styling, or a comparable product by one of the following:
      a. TOTO.
      b. Kohler Co.
   2. Description: Wall-mounting, vitreous-china fixture.
      a. Type: Lucia
      b. Size: 35 ½” by 20 ½” .
      c. Faucet Hole Punching: One hole.
      d. Faucet Hole Location: Top center.

e. Color: White.
f. Faucet: Lavatory L-1.
g. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
h. Drain: Grid.
i. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chrome-plated, cast-brass P-trap; NPS 1-1/2 (DN 40) tubular brass waste to wall; and wall escutcheon.
j. Fixture Support: See Section 2.4.

2.7 SHOWERS

A. Shower SH-1:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Aquatic 1363BFSC, or a comparable product by one of the following:
a. American Standard Companies, Inc.
b. Aquarius.
c. Kohler Co.
d. Aqua Bath Company, Inc.
2. Description: Transfer shower stall, ADA compliant, one piece gel coat construction, open top enclosure, and factory installed shower rod.
a. Exterior dimensions: 38” x 38 ¼” x 77” high
b. Color: White, smooth surface.
c. Drain Location: Center.
d. Surface: Slip resistant textured bottom.
e. Threshold: ¾” skirt.
f. Shower rod: Stainless steel.
g. Faucet: Shower SH-1.
h. Drain: Grid, NPS 2 (DN 50).
i. Special Instructions: Install with wood reinforcements between shower enclosure and wall for future ADA grab bar location.

2.8 SERVICE BASINS

A. Service Basins, MR-1:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Fiat model MSBID2424 or a comparable product by one of the following:
a. Stern-Williams Co., Inc.
b. Swan Corporation.
c. Zurn Plumbing Products Group; Light Commercial Operation.
d. Florestone.
2. Description: Flush-to-wall, floor-mounting, molded stone fixture with rim guard.
a. Shape: Square.
b. Size: 24 by 24 inches (915 by 610 mm).
c. Height: 10 inches (255 mm).
d. Wall Guard: stainless steel
e. Tiling Flange: Not required.
f. Rim Guard: Vinyl bumper guard.
g. Color: Not applicable.
h. Faucet: See specification section 2.3-A.
i. Drain: Grid with NPS 2 (DN 50) outlet.
j. Options: Provide QIC32, quick drain connector, 832AA, hose and hose bracket, and 889CC mop hanger.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

C. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

D. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

E. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust high temperature limit stops on faucets. Replace damaged and malfunctioning units.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
   1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
   2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities.

END OF SECTION 224000

SECTION 224700 - DRINKING FOUNTAINS AND WATER COOLERS

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 water coolers and related components:
1. Pressure water coolers.

1.3 DEFINITIONS

A. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.

B. Cast Polymer: Dense, cast-filled-polymer plastic.

C. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

D. Drinking Fountain: Non-electrically powered fixture for generating and delivering drinking water.

1.4 SUBMITTALS

A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For fixtures 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 101-336, "Americans with Disabilities Act" ; for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 WATER COOLERS

A. Water Cooler EWC-1:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay or a comparable product by one of the following:
   a. Halsey Taylor.
   b. Oasis Corporation.
   c. Sunroc Corp.
2. Description: Model LZSTL8WSLK, wall-mounted, lead free water cooler and bottle filling station for adult and child-mounting height.
   a. Cabinet: Bilevel with two attached cabinets with antimicrobial protected plastic components to prevent mold.
   b. Bubbler: Vandal resistant Flexi-Guard Stream Saver Bubbler, laminar flow.
   c. Control: Push bar activation.
   d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
   e. Filter: WaterSentry Plus 3000 gallon filter.
   f. Drain(s): Grid with NPS 1-1/2 minimum horizontal waste and trap complying with ASME A112.18.1.
   g. Bottle Filling Station: No touch, sensor activation with automatic 30 second shut off timer.
   h. Display: Filter monitor indicating when replacement is necessary.
   i. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
      1) Capacity: 8.0 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg (32 deg C) ambient air temperature.
      2) Electrical Characteristics: 120-V ac; single phase; 60 Hz.
   j. Support: Type II, water cooler carrier. Refer to "Fixture Supports" Article.

2.2 FIXTURE SUPPORTS

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. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
2. Zurn Plumbing Products Group; Specification Drainage Operation.

C. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
1. Type II: Bilevel, hanger-type carrier with three vertical uprights.
2. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

3.3 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

C. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding."

D. Connect wiring according to Division 26 Section "Wire and Cable".

3.5 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
   1. Remove and replace malfunctioning units and retest as specified above.
   2. Report test results in writing.

3.6 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

3.7 CLEANING

A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide labor, materials, accessories, and other related items as required to complete operations in connection with the complete installation of the HVAC and mechanical systems as indicated on the Drawings and as specified herein.

1.2 RELATED REQUIREMENTS

A. Conditions of the contract apply to the work, including the work of this Division. Examine Contract Documents for requirements affecting the work.

B. Provide cooperation with, and assistance to, the Commissioning Agent as specified under AResponsibilities@ in Division 01 Section "General Commissioning Requirements"

C. Provide cooperation with and assistance to, the Testing and Balancing (TAB) Agent specified in Division 01 Section "Testing, Adjusting, and Balancing for Mechanical Systems."

1.3 MECHANICAL PRE-CONSTRUCTION MEETING

A. Conduct a mechanical conference at Project site to comply with requirements of Division 01 Section "Project Management and Coordination" and the following:
   1. At least 14 days prior to beginning of mechanical work, conduct a meeting to review detailed requirements for mechanical systems installation and testing requirements. Review mechanical Drawings and Specifications, discuss project specific details and requirements, and review and discuss expectations for quality control. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with mechanical systems installation to attend conference, including, but not limited to, the following:
      a. General Contractor's superintendent.
      b. Mechanical Subcontractors= project managers.
      c. Mechanical Subcontractors= job foremen.
      d. Commissioning agent
      e. Sheetmetal job foreman.
      f. Plumbing job foreman.
      g. Controls job foreman.
      h. Project mechanical Engineer/designer.
      i. Job clerk.
      j. Architect=s construction administrator.

1.4 DRAWINGS

A. The general location of the apparatus and the details of the work are indicated on the Drawings. Exact locations not indicated shall be determined at the site as the work progresses and shall be subject to the Architect's approval.

B. It is not intended that the Drawings shall show every pipe, pipe rise, pipe drop, duct rise, duct drop, pipe fitting, duct fitting, or appliance, but it shall be a requirement to furnish, without additional expense, material and labor necessary to complete the systems in accordance with the design intent and with the highest possible quality available.

1.5 ALTERATIONS

A. Execute alterations, additions, removals, relocations, new work, and other related items as indicated or required to provide a complete installation in accordance with the intent of the Contract Documents, including changes required by building alterations.

B. Existing work disturbed or damaged by the alterations or the new work shall be repaired or replaced to the Architect's satisfaction and at no additional cost to the Owner.

C. Existing ductwork, piping, and other systems indicated to be removed, shall be removed from the site. Cap off existing services remaining. The Owner retains the right to ownership of heating and ventilating equipment scheduled to be removed; store such equipment where requested by the Owner. Material not retained by the Owner shall be removed from the site.

1.6 CONTINUITY OF SERVICE

A. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted service for the building or any of its locations. Any unavoidable conditions requiring reduced building capacity shall be arranged for by programming with the Owner's duly authorized representative at the building subject to the Architect's approval. If necessary, temporary work shall be installed to provide for the condition. Authorization for interrupting service shall be obtained in writing from the Owner. Any interruption of normal service shall be performed during an overtime period to be scheduled with the Owner. Costs for overtime work shall be included in the bid.

1.7 ELECTRIC WORK

A. Provide motors, pilot lights, controllers, limit switches, and other related items for equipment provided under Division 26, Electric.

B. Except as noted, required line switches, fused switches, and other related items and necessary wiring to properly connect equipment to motors and switches shall be furnished and installed under Division 26, Electric.

C. Provide complete wiring system for automatic temperature controls as specified under Division 23 Section “Instrumentation and Controls for HVAC.”

D. Wiring shall conform to the requirements of the National Electrical Code.

1.8 REQUIREMENTS

A. Installation Instructions: Obtain manufacturer's printed installation instructions to aid in properly executing work on major pieces of equipment. Install equipment in accordance with manufacturer=s recommendations.

B. Objectionable Noise, Fumes and Vibration:

1. Mechanical and electrical equipment shall operate without creating objectionable noise, fumes, or vibration, as determined by the Architect.
2. If such objectionable noise, fumes, or vibration is produced and transmitted to occupied portions of building by apparatus, piping, ducts, or any other part of mechanical and electrical work, make necessary changes and additions, as approved, without extra cost to Owner.

C. Equipment Design and Installation:
1. Uniformity: Unless otherwise specified, equipment or material of same type or classification, used for same purposes, shall be product of same manufacturer.
2. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog number shall be designed in conformity with ASME, IEEE, or other applicable technical standards, suitable for maximum working pressure, and with neat and finished appearance.
3. Installation: Erect equipment aligned, level and adjusted for satisfactory operation. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements may be made, as approved.

D. Hanging of Equipment, Ductwork and Piping:
1. Support equipment, ductwork and piping from the top chord of bar joists at the APanel Points@ or from the top flange of beams. Piping 2" (51 mm) nominal and smaller may be supported from the bottom chord of the bar joists at the APanel Points@ or from the bottom flange of the beams.

E. Protection of Equipment and Materials: Responsibility for care and protection of materials and mechanical work rests with the Contractor until the entire project has been completed, tested and the project is accepted by the Owner.

F. Foundations:
1. Ceiling Mounting: Where ceiling mounting is indicated or specified, use suspended platform or strap hangers, bracket or shelf, whichever is most suitable for equipment and its location. Construct of structural steel members, steel plates, or rods, as required; brace and fasten to building structure or to inserts as approved, or as detailed.
2. Where floor mounting is indicated, locate equipment on 4 inch (102 mm) high reinforced concrete pad of adequate size with anchors and base plates as required, on pressure-treated sleepers, or on structural steel frame as detailed. The corners of pads shall be chamfered 1/2 inch (13 mm). Pad and steel sizes and location shall be coordinated with the approved equipment.

1.9 ADJUSTMENTS AND OWNER'S INSTRUCTIONS

A. After completion of the installation work called for in the Contract Documents, furnish necessary mechanics or engineers for the adjustment and operation of the systems, to the end that the systems are perfectly adjusted and turned over to the Owner in perfect working order. Further instruct the Owner's authorized representative in the care and operation of the installation, providing framed instruction charts, directions, and other related items.

1.10 TESTING

A. After the entire installation is completed and ready for operation, test the systems as outlined in Division 01 Section “Testing, Adjusting and Balancing for HVAC.” These tests are supplementary to detailed tests specified herein or directed. The Owner will provide water and electric current for the test. Provide necessary labor, test pump, gauges, meters, other instruments, and materials. Perform tests in the presence of the Architect or his representative.

1.11 FIRESTOPPING

A. Firestopping for penetrations of ductwork, piping and equipment through fire rated and smoke rated partitions, walls, floors, ceilings, and roofs shall be furnished and installed under this Section.

B. Refer to Architectural Drawings for locations of fire rated and smoke rated partitions, walls, floors, ceilings, and roofs.

1.12 ACCESS PANELS

A. Access panels required for items furnished under Division 23 shall be provided under this Division.

B. Selection and installation of access panels shall be in accordance with Manufacturer, and Model of standard doors: J. L. Industries, Inc., Model WB; Karp Associates, Inc., Model KDW; or The Williams Brothers Corporation of America, Model WB-DW. **If referencing Access Doors and Frames, delete the bracketed items below.**

C. Access panels shall be standard panels, 12 in. x 16 in. (305 mm x 406 mm) minimum unless indicated otherwise. Door shall be flush type of 14-gauge steel hinged to 16-gauge frame with drywall bead. Panels installed in areas of high moisture concentration, such as locker rooms, near plumbing fixtures, food preparation areas, or outdoors, shall be fabricated of paintable stainless steel or aluminum for corrosion resistance.

D. Doors and frames shall be factory primed. Latches shall be operated by tumbler lock, keyed alike, furnish 3 keys to the Owner.

E. Access panels in fire-rated construction shall have the same UL rating as the building assembly in which they are installed.

F. Provide access panels in building construction where required for access to duct access doors or other components such as valves, air vents, actuators, volume dampers, motorized dampers in ductwork, duct smoke detectors, and other related items.

1.13 SUBMITTALS

A. After award of Contract and before installation, submit for approval Shop Drawings, bulletins, Product Data, and other related items.

B. Submit Shop Drawings and Product Data as required in each section. Submittal shall include physical data and performance data required to verify compliance with the Contract Documents.

1.14 OPERATING AND MAINTENANCE MANUALS

A. Furnish two (2) bound operating and maintenance manuals and forward to the Architect for review and transmittal to the Owner.

B. For maintenance purposes, provide approved Submittals, parts lists, specifications, and manufacturer's maintenance bulletins for each piece of equipment. For materials used which have been submitted to the Architect for approval but do not require regular maintenance, such as piping, ductwork, and insulation, provide one copy of approved Submittals.

C. Provide name, address and telephone number of the manufacturer's representative and service company, for each piece of equipment or material so that service or spare parts can be readily obtained.

1.15 CLEANING

A. Remove debris from site daily.

B. Material and pieces of equipment shall be turned over to the Owner free of dust and dirt, both inside and out.

C. At the completion of the Project, equipment shall have a clean, neat appearance of factory finish by cleaning or repainting as required.

D. At the completion of the Project, surfaces exposed to view shall have a clean, neat appearance of finish free from smudges and scratches by cleaning or repainting as required.

1.16 SUBSTITUTIONS

A. Comply with provisions of the Instructions to Bidders and General Conditions.

B. The first item listed under "Acceptable Manufacturers" is the design basis. Other manufacturers listed may be used in the base bid, but conformance with details of the Specifications, as well as dimensional and electrical data, shall be verified by the Contractor. Modifications required as a result of differences between the design basis item and the submitted and approved item shall be approved by the Architect and made at the Contractor's expense. As an example, if a rooftop HVAC unit is submitted and approved and if the unit=s dimensions and weight are different from those of the unit which was used as the design basis, the Contractor shall be responsible for building structural modifications required to accommodate the submitted and approved unit, at no additional cost to the Owner. For items that have no manufacturers listed, any item conforming with the Contract Documents is acceptable.

1.17 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Divisions having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of work of separate Sections in preparation for Substantial Completion.

F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.18 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Commissioning Agent seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturer-s instructions.

G. When specified in individual Specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.19 FACTORY START-UP AND START-UP REPORTS

A. Provide factory start-up of mechanical equipment listed below. Factory start-up shall be performed by a factory authorized representative of the equipment manufacturer. When factory start-up is successfully completed for each piece of mechanical equipment listed below, submit a formal start-up report to the Architect for approval. Start-up report shall be
formatted in accordance with equipment manufacturer-s recommendations. Start-up report shall be

typed, not hand written, and shall be submitted in a clean and legible form.

B. Equipment requiring factory start-up:
   1. Packaged roof top gas fired AC unit

1.20 REQUESTS FOR ARCHITECT=S CADD DRAWINGS

A. In lieu of generating their own CADD drawings, the Contractor may elect to use the Architect=s electronic copies of CADD drawings for the purpose of developing coordination drawings, developing control system graphics or for other reasons that pertain to the requirements of this Contract. If the Contractor elects to utilize the Architect=s electronic copies of CADD drawings, the electronic files shall be purchased from the Architect at the Architect=s current billing rate per drawing. The Contractor shall provide payment and shall sign a release-of-liability form before electronic CADD drawings are released.

1.21 SEISMIC DESIGN

A. This project requires special provisions for the support and restraint of piping, ductwork and equipment. These provisions shall be incorporated in accordance with the following:
   1. The requirements of this Section are complementary to requirements listed elsewhere for the fastening and support of piping, ductwork, and equipment. Nothing indicated on the Drawings or in other Sections of these Specifications shall be interpreted as a reason to waive the requirements of this Section.
   2. Piping, ductwork and equipment shall be adequately supported and restrained to resist seismic forces in accordance with section 301.15 of the 2003 International Mechanical Code and with chapter 16 of the 2003 International Building Code and associated supplements.
   3. Seismic restraints for piping and ductwork:
      a. Piping and ductwork not listed as exempt from the requirements for seismic restraints shall be seismically restrained in accordance with the following publications:
         1) Sheet Metal and Air Conditioning Contractors National Association (SMACNA) SEISMIC RESTRAINT MANUAL GUIDELINES FOR MECHANICAL SYSTEMS, Second Edition - 1998
         2) APPENDIX E - Sheet Metal and Air Conditioning Contractors National Association (SMACNA) SEISMIC RESTRAINT MANUAL GUIDELINES FOR MECHANICAL SYSTEMS, Second Edition - 1998

1.22 COMPLETION OF SYSTEMS

A. The following mechanical systems shall not be complete until the following conditions are satisfied:
   1. Ductwork Systems:
      a. Ductwork and related components and accessories shall be completely installed and insulated as specified.
      b. Ductwork leakage testing shall be completed and leakage testing reports shall be submitted and approved.
      c. Ductwork shall be balanced and a balancing report shall be submitted and approved.
      d. Commissioning shall be completed.
   2. Piping Systems:
      a. Piping, valves and accessories shall be completely installed, insulated and labeled as specified.
      b. Piping pressure testing be completed and pressure testing reports shall be submitted

and approved.

c. Piping systems shall be balanced and a balancing report shall be submitted and approved.

d. Commissioning shall be completed.

3. Equipment:

a. Equipment, including but not limited to boilers, heat exchangers, terminal heat transfer units, pumps, air handling units, condensing units, chillers, split system air conditioning equipment, and exhaust fans, shall be completely installed.

b. Equipment start-up reports shall be completed, submitted and approved.

c. Equipment balancing shall be completed and the balancing report shall be submitted and approved.

d. Commissioning shall be completed.

4. Automatic Temperature Controls (ATC):

a. ATC system shall be completely installed.

b. Commissioning shall be completed.

c. ATC system shall operate in an automatic mode for a minimum of four (4) months during Owner occupancy without substantial deficiencies.

1.23 WARRANTY

A. Provide guarantees and warranties for work under this Contract as indicated in the general requirements of the Contract.

B. Provide manufacturers' standard warranties and guarantees for work by the mechanical trades. However, such warranties and guarantees shall be in addition to and not in lieu of other liabilities which the manufacturer and the Mechanical Contractor may have by law or by other provisions of the Contract Documents.

C. Guarantee that elements of the systems provided under this Contract are of sufficient capacity to meet the specified performance requirements as set forth in these Specifications or as indicated on the Drawings.

D. Upon receipt of notice from the Owner of failure of any part of the mechanical systems or equipment during the warranty period, the Mechanical Subcontractor shall replace the affected part or parts.

E. Furnish a written guarantee covering the above requirements before submitting the application for final payment.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

A. Access panels required for items furnished under Division 23 shall be provided under this Division.

B. Access panels shall be standard panels, 12 in. x 16 in. (305 mm x 406 mm) minimum unless indicated otherwise. Panels installed in areas of high moisture concentration, such as locker rooms, shall be fabricated of paintable stainless steel or aluminum for corrosion resistance. Access panels in fire-rated construction shall have the same UL rating as the building assembly in which they are

installed.

C. Provide access panels in building construction where required for access to duct access doors or other components such as valves, air vents, actuators, volume dampers, motorized dampers in ductwork, duct smoke detectors, and other related items.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 230500

SECTION 230513 - 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.

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. Manufacturers:
   1. Baldor.
   2. Century.
   3. General Electric.
   4. Westinghouse.

B. I.T.E. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

C. Comply with NEMA MG 1 unless otherwise indicated.

D. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3,300 feet (1,000 m) 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: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: NEMA Class B or better

J. Code Letter Designation:
   1. Motors 15HP and Larger: NEMA starting Code F or Code G.
   2. Motors smaller than 15HP: 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 Multi-speed 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.

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. Single Phase Power – Split Phase Motors:

a. Starting Torque: Less than 150 percent of full load torque.
b. Starting Current: Up to seven times full load current.
c. Breakdown Torque: Approximately 200 percent of full load torque.
d. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
e. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2. Single Phase Power – Permanent-split Capacitor Start Motors:
a. Starting Torque: Exceeding one fourth of full load torque.
b. Starting Current: Up to six times full load current.
c. Multiple Speed: Through tapped windings.
d. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

3. Single Phase Power – Capacitor Start Motors:
a. Starting Torque: Three times full load torque.
b. Starting Current: Less than five times full load current.
c. Pull-up Torque: Up to 350 percent of full load torque.
d. Breakdown Torque: Approximately 250 percent of full load torque.
e. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
f. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated bearings.
g. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

B. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, 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.

2.6 STARTERS AND OVERLOADS

A. Manufacturers:
1. Cutler Hammer.
2. Westinghouse.
3. General Electric.
4. Square D.
5. I.T.E.

B. Motor starters shall be furnished for motors provided under this Section of these specifications. Each 3 phase motor starter shall have a 3-pole type, three element overload device and shall have "ON-AUTO-OFF" switch in cover plate. They shall be general purpose NEMA rated for

connected H.P. (definite purpose starters not acceptable) and shall have control power with fused transformers as required. Coordinate control voltage with Controls Contractor. Provide auxiliary contacts where required for interlocking of electrical equipment. Provide two-speed motor starters where indicated.

1. Single phase motors shall have one of the following factory wired methods of motor protection:
    a. Integral thermal overload protection in motor and cord with plug and receptacle in unit casing.
    b. Integral thermal overload protection in motor and disconnecting switch mounted in or on casing as specified with equipment.
    c. Switch with thermal overload protection for unprotected motors with switch serving as disconnect device.

C. Thermal overload devices shall be sized for motor nameplate full load amps or field measured amp draw, whichever is less. Replace elements as required by field measurements.

D. For starters that are associated with equipment that is required to be shut down upon a fire alarm condition, provide input contacts within the starter enclosure to interface with the building's fire alarm system. Upon receipt of a signal from the building's fire alarm system, power to load side of the starter shall be turned off. Circuitry shall be provided to ensure that power is off whether the starter is in the "AUTO", "HAND" or "BYPASS" mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements of Division 26.

2.7 V-BELT DRIVES

A. Provide self-aligning roller-bearings mounted in sealed housings with grease fittings and grease overflow valves. Fan wheels and shafts shall be designed for critical speed at least 20% higher than the maximum fan speed. The assembled fan shall be statically and dynamically balanced at the factory. Bearings shall be certified to have an average life per AFBMA of not less than 200,000 hours.

B. Belt drives shall be adjustable. The base shall be constructed to allow adjustment of belt tension without having to loosen motor hold-down bolts. Belts and pulleys shall be designed for a minimum 1.5 safety factor.

2.8 VARIABLE FREQUENCY DRIVES

A. Manufacturers:
1. Emerson
2. Toshiba.
3. ABB.
4. Danfoss.
5. Yaskawa.
6. Honeywell

B. Quality Assurance:
1. Manufacturer: shall specialize in manufacture, assembly, and field performance of Variable Frequency Drives with minimum five (5) years experience.

2. The variable frequency drive manufacturer shall have an existing representative, exclusively for HVAC applications, an independent service and start-up organization, and a parts stocking depot local to the installation.

C. The variable frequency drives (VFDs) with options shall be UL listed as a complete assembly and shall be built in compliance with the latest standards of ANSI, IEEE, NEMA and the National Electric Code.

D. The VFDs shall be designed to meet the requirements of the following standards: IEC801-2, IEC801-4, IEC255-4.

E. Warranty and Start-Up Service:
1. The VFD manufacturer shall provide a start up service package for the VFDs. Service shall include inspection, final adjustment, operational checks, coordination with interface to building's DDC system (coordinate with section 230900 and 230993) and a final report for record purpose. Start-up service shall be performed by a factory approved and certified technician.
2. The VFD manufacturer shall include a full parts and labor on-site warranty for a period of two years after substantial completion.

F. Construction:
1. The VFD shall be of the Pulse Width Modulated design converting the fixed utility voltage and frequency to a variable voltage and frequency output. The VFD shall employ a full wave bridge rectifier, DC bus choke, DC bus filter capacitors, and Insulated Gate Bipolar Transistors (IGBTs) as the output switching device. SCRs, GTOs and Darlington transistors are not acceptable. The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.
2. The VFD shall be configured with a 6-pulse (minimum) converter section. Provide 3% line reactors to reduce harmonic current distortion.
3. Provide a DC link choke as manufactured by MTE Corporation, between the input rectifier and bus capacitor.
4. The VFD shall be housed in a NEMA 1 metal enclosure.
5. Standard operating conditions are:
   a. Incoming three phase 460 volt AC power +/- 10%, 60 Hz.
   b. Humidity 0 to 95% (noncondensing and noncorrosive).
   c. Altitude 0 to 3,300 feet above sea level, without derating.
   d. Ambient temperature 32 to 104 deg F (0 to 40 deg C).
6. The VFDs shall include the following features:
   a. Customer interface, including digital display in plain English (code numbers are not acceptable), keypad and customer connections.
   b. In addition to the keypad, a pre-wired 3-position Hand-Off-Auto switch and manual potentiometer.
   c. An integral reactor to reduce the harmonics to the power line.
   d. Optimized for a 3kHz carrier frequency to reduce motor noise. The carrier frequency shall be adjustable by the start-up technician.
   e. The option of either (1) displaying a fault, (2) running at a preset speed, or (3) running at the last known speed (average of last 10 seconds) if the input reference (4-20mA or 2-10V) is lost.
   f. Automatic restart after an overcurrent, overvoltage, or undervoltage, or loss of input signal protective trip. The number of restart attempts and trial time shall be programmable.

g. The ability to start into a rotating load (forward or reverse) and accelerate or decelerate without safety tripping or component damage (flying start).
h. An automatic power loss ride through circuit that will utilize the inertia of the load to keep the drive powered. Minimum power loss ride through shall be 1 cycle based on full load and no inertia.
i. Isolated power for control circuits.
j. Input line fuses.
k. Disconnect switch.
l. Acceptable start/stop commands shall include closure of a contact or switch, application and removal of input power and optional application and removal of 115 VAC on-off signal.
m. Load loss detection. Each VFD shall provide a dry contact closure at a field adjustable load threshold to indicate a loss of motor load (e.g. broken fan belt and/or pump cavitation).
n. A pilot light cluster to provide visual indication of protective functions and circuit status. Pilot light cluster shall include the following LEDs:
    1) Power on (Red): Illuminates whenever main power is applied to the controller.
    2) AFC Run (Green): Illuminates to annunciate a drive run condition.
    3) AFC Fault (Yellow): Illuminates to annunciate a fault condition.

7. VFDs shall include the following features:
    a. Five programmable critical frequency lockout ranges to prevent the VFD from continuously operating at an unstable speed.
    b. PI setpoint controller integral to the drive, allowing a pressure or flow signal to be connected to the VFD, using the VFD for the closed loop control, eliminating the need for external controllers.
    c. Three programmable digital relay outputs. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 amps at 250 VAC; maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS.
    d. Seven programmable preset speeds.
    e. Six programmable digital inputs for maximum flexibility in interfacing with energy management system.
    f. Two independently adjustable acceleration and deceleration ramps. These ramps shall be adjustable from 1 to 1800 seconds.
    g. Ramp or coast to a stop.
    h. Two programmable analog outputs to provide 4-20 ma signals linear to output frequency, motor speed, output current, motor torque, motor power, DC bus voltage, and motor voltage.
8. VFD door mounted operator digital display shall include:
    a. Output Frequency
    b. Motor Speed (RPM)
    c. Motor Current
    d. Calculated Motor Torque
    e. Calculated Motor Power
    f. DC Bus Voltage
    g. Output Voltage
    h. Heatsink Temperature
    i. Analog Input Valves
    j. Keypad Reference Values
    k. Elapsed Time Meter

9. VFD speed command input shall include:
    a. Keypad.
    b. Two analog inputs, each capable of accepting a 0-20 mA, 4-20mA, 0-10V, 2-10V signal inputs isolated from ground, and programmable via the keypad for different uses. Analog inputs shall have a programmable filter to remove any oscillation of the reference signal. The filter shall be adjustable from 0.01 to 10 seconds. The analog input shall be able to be inverted, so that minimum reference corresponds to maximum speed, and maximum reference corresponds to minimum speed.
    c. Floating point input to accept a three wire input from a Dwyer Photohelic or equivalent type instrument.
    d. RS-485 communications.
10. The VFD shall include the following protection circuits. In the case of a protective trip, the drive shall stop, and announce the fault condition in plain words.
    a. Overcurrent trip 200% of the VFD's variable torque current rating.
    b. Overvoltage trip 130% of the VFD's rated voltage.
    c. Undervoltage trip 60% of the VFD's rated voltage.
    d. Over temperature 158 deg F (70 deg C).
    e. Ground fault.
    f. Adaptable Electronic Motor Overload: Shall protect the motor based on speed, load curve, and external fan parameter. Circuits that protect the motor only at full speed are unacceptable.
    g. Power line surge protection by means of a metal oxide varistor (m.o.v.).
11. The following accessories shall be furnished and mounted by the drive manufacturer and contained in a single enclosure. The use of more than one enclosure is not acceptable.
    a. Prewired hand-off automatic switch (HOA).
    b. Customer Interlock Terminal Strip: Provide a separate terminal strip for connection of fire, smoke, freeze contacts and external start command. External interlocks and start/stop contacts shall function with drive in hand, auto or bypass.
    c. Door-interlocked disconnect or circuit breaker, padlockable in off position.
    d. Manual transfer to line power via contactors, including class 20 bimetal motor thermal overload relays and fuse or circuit breaker protection while in bypass operation, with automatic bypass capability.
12. Energy Management System Interface
    a. In addition to analog and digital I/O the VFD shall be capable of communicating with the following controls companies' communication buses with no extra hardware:
        1) Honeywell Controls (the existing primary control system of the school district)
13. In the event of a power failure and upon restoration of power, the variable frequency drive shall remain responsive to its command signal from the building's energy management/temperature control system. The drive shall not require manual resetting after a power outage in order to respond to the energy management/temperature control system's command signal.
14. For drives that are associated with equipment that is required to be shut down upon a fire alarm condition, provide input contacts within the VFD enclosure to interface with the building's fire alarm system. Upon receipt of a signal from the building's fire alarm system, power to load side of the VFD shall be turned off. Circuitry shall be provided to ensure that power is off whether the VFD is in the "AUTO" or "HAND" mode. If this feature is not available from the VFD manufacturer, provide a contactor on the line side of the VFD to accomplish the same function. The contactor shall meet the requirements of Division 26.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Check line voltage and phase and ensure agreement with nameplate.

B. Variable Frequency Drives:
   1. Provide separate metal conduits for drive input power, output power to the motor, and control wiring. Output motor cables from multiple drives shall be run separately.
   2. Perform factory startup service (see Part 2 of this Section). Submit reports.

END OF SECTION 230513

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and equipment hangers and supports.

B. Equipment bases and supports.

C. Sleeves and seals.

D. Flashing and sealing equipment and pipe stacks.

E. Non-penetrating roof mounted pipe support system.

1.2 RELATED SECTIONS

A. Division 09 Section “Painting.”

B. Division 23 Section “HVAC Equipment Insulation.”

1.3 REFERENCES

A. ASME B31.2 - Fuel Gas Piping.

B. ASME B31.9 - Building Services Piping.

C. ASTM A653 G90 SS Gr. 33 - Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dipped Process.

D. ASTM B633 B Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

E. ASTM C642 B Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

F. ASTM C672 B Test Methods for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

G. ASTM D412 B Test Methods for Vulcanized Rubber and Thermoplastic Elastomers B Tension.

H. ASTM D395 B Standard Test Methods for Rubber Property B Compression Set.

I. ASTM D573 B Test Method for Rubber B Deterioration in an Air Oven.

J. ASTM D746 B Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

K. ASTM D2240 B Test Method for Rubber Property B Durometer Hardness.

L. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

M. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

N. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

O. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

P. NFPA 13 - Installation of Sprinkler Systems.

Q. NFPA 14 - Installation of Standpipe and Hose Systems.

R. NFPA 70 B National Electrical Code

S. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures”.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data: Provide manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for support of hydronic piping.

B. Supports for Standpipes: In conformance with NFPA 14.

C. Supports for Electrical: In conformance with NFPA 70.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Grinnell.
2. Cooper B-Line.
3. Carpenter & Paterson.

B. Hydronic Piping:
1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.

5. Hangers for Hot Pipe Sizes 5 Inches (125 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Cold Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 5 Inches (125 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Refrigerant Piping:
1. Conform to ASME B31.5, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded, double nuts on all hangers with double washers.

2.3 INSERTS

A. Manufacturers:
1. Grinnell.
2. B-Line.

B. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gauge (0.5 mm) thick galvanized steel.

B. Metal Counterflashing: 22 gauge (0.8 mm) thick galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 lb/sq ft (24.5 kg/sq m) sheet lead
   2. Soundproofing: 1 lb/sq ft (5 kg/sq m) sheet lead.

D. Flexible Flashing: 47 mil (1.2 mm) thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gauge (0.8 mm) minimum; 16 gauge (1.5 mm) at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gauge (1.2 mm) thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gauge (1.2 mm) thick galvanized steel.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel.

F. Stuffing or Firestopping Insulation: Glass fiber type, non-combustible.

G. Sealant: Acrylic.

2.6 NON-PENETRATING ROOF-MOUNTED PIPE SUPPORT SYSTEM

A. Product: C-Port as manufactured by Cooper B-Line Inc., or approved equal.

B. Curb Base:
   1. 100% recycled rubber and polyurethane prepolymer, UV resistant.
   2. Support capacity of 2500 pounds per linear foot of support. Note: Consult roofing manufacturer; the weakest point may be the insulation board beneath the roof membrane.
   3. Each base shall have a reflective yellow stripe.
   4. Base Dimensions: 6 inches wide, 4 inches tall, with length as selected by the manufacturer for the load and roof conditions.

5. Material Properties:

Property			Value	Standard
a.	Density		0.6 oz/cu in	ASTM C642
b.	Durometer Hardness		65A " 7	ASTM D2240
c.	Tensile Strength		210 psi minimum	ASTM D412
d.	Compression Deformation 10% at 70psi and 68•F			ASTM D395
e.	Brittleness at Low Temp		-401F	ASTM D746
f.	Freeze and thaw when exposed to deicing chemicals		No loss after 50 cycles	ASTM C672
g.	Coefficient of Thermal			
h.	Expansion		8 x 10-6 in/in/•F (min)	ASTM C531
i.	Weathering, 70 hours at 12•F			ASTM D573
	1)	Hardness retained	100% ("5%)	
	2)	Compressive strength	100% ("5%)	
	3)	Tensile strength	100% ("5%)	
	4)	Elongation retained	100% ("5%)	

C. Steel Frame: Steel strut, hot-dip galvanized per ASTM A653, 14 ga. strut for C and CE series, 12 ga strut for CB and CS series. Struts may be epoxy-coated equal to B-Line=s Dura-Green or Dura-Copper coatings in lieu of galvanizing.

D. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633.

E. Gas Pipe Support: C-Port model #CXP base dimensions: 6-inch wide by 4-inch tall by 9.6 inch length. Use with one piece galvanized pipe clamp, one pipe size larger than gas pipe and fastened directly into rubber material with weather resistant type 12 lag screws. For 2 - 3 2 inch nominal pipe size, use Roller Support (see below).

F. Multi-Pipe/Equipment Support: C-Port single-base C-Series models with 13/16" strut, or dual-base CB-Series ABridge Type@ with 1-5/8" strut. Strut attached to base for fastening of accessories. Select length to suit number of pipes or equipment fastened, allowing 1-inch of space at either end of support.

G. Extendible Height Support: C-Port Model CE10-8, CE10-12, or CE10-16, with 8-inch, 12-inch or 16-inch height to suit application. 13/16" strut for fastening accessories. Two 1/2-inch all-thread rods per 9-inch base (select base length as required), with nuts and washers. Standard load rating is 200 pounds per foot due to point loading at support rods; CLDP10 11-ga. load distribution plates may be used for increased loading. For heavier loads, additional height options and variable angle options, use C-Port CS-Series with B22 channel to field-fabricate an AH@ frame support for additional stability.

H. Roller Support: C-Port CR-Series with 12-inch overall height, with B3114-3-1/2 pipe roll with sockets, for piping outside diameters up to 3-1/2". Two 1/2-inch all-thread rods per 9-inch base, with nuts and washers. Standard load rating is 200 pounds per foot due to point loading at support rods; CLDP10 11-ga. load distribution plates may be used for increased loading.

I. Variable Angle/Height Support: C-Port CS-Series with 1-5/8" strut channel, 1/4"-thick x 5-3/4" long adapter leg to accommodate 1-5/8" strut, and connecting hardware.

J. Pipe/conduit clamps shall be channel style, B-Line B2000 or B2400 series or approved equal, made of galvanized steel (or steel with coating to provide equivalent protection for outdoor use). For refrigeration pipes, provide B-Line Vibra-Cushion or Vibra-Clamp internally cushioned clamps. Provide copper plated pipe support where metal is in contact with copper pipe.

K. Provide extendible height supports when spacing above roof, or sloping of pipe to drain, or both, are required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. All hangers shall be attached to top of chord of structure.

3.2 INSERTS

A. Provide inserts for placement in concrete formwork.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

C. Place hangers within 12 inches (300 mm) of each horizontal elbow.

D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Refer to Division 09 Section “Painting”. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Do not support pipes from other pipes or equipment.

M. Size pipe hangers to accommodate continuous piping insulation.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches (100 mm) thick and extending 6 inches (150 mm) beyond supported equipment, with 1-inch (25 mm) chamfered edges. Provide dowels to fasten pad to structural floor. Refer to Division 03. Unless otherwise shown or specified, floor-mounted major equipment shall be set on housekeeping pads and anchored to housekeeping pads. This shall include but not be limited to, air handling units, compressors, base mounted pumps, boilers, converters, heat exchangers, storage tanks and expansion tanks, etc.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

E. Do not support equipment from pipes or from other equipment.

F. Edges shall be chamfered.

3.5 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weatherproofed or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches (75 mm) minimum above finished roof surface with lead worked 1 inch (25 mm) minimum into hub, 8 inches (200 mm) minimum clear on sides with 24 x 24 inches (600 x 600 mm) sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counterflash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches (250 mm) clear on sides with minimum 36 x 36 inch (910 x 910 mm) sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower and mop sink drains watertight to adjacent materials.

E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in

accordance with manufacturer's instructions for sound control.

F. Provide curbs for mechanical roof installations 14 inches (350 mm) minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints. Curbs shall be designed for pitched roofs where applicable.

G. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors 1 inch (25 mm) above finished floor level. Caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.7 NON-PENETRATING ROOF-MOUNTED PIPE SUPPORT SYSTEM

A. Install in accordance with manufacturer-s instructions and recommendations.

B. If roof has stone or gravel ballast, remove ballast around and under pipe support.

C. Consult roofing manufacturer for roof membrane and insulation compression capacities. If necessary, a compatible sheet of roofing material (rubber pad) may be installed under rooftop support to disperse concentrated loads and add further membrane protection.

D. Gas pipe support spacing shall conform to requirements of local gas authorities.

E. Use properly sized clamps to suit pipe sizes.

3.8 SCHEDULES

PIPE SIZE		HANGER ROD MAX. HANGER SPACING		DIAMETER	
Inches	(mm)	Feet	(m)	Inches	(mm)
1/2 to 1-1/4	12 to 32	6.5	2	3/8	9
1-1/2 to 2	38 to 50	10	3	3/8	9
2-1/2 to 3	62 to 75	10	3	1/2	13
4 to 6	100 to 150	10	3	5/8	15
8 to 12	200 to 300	14	4.25	7/8	22
14 and Over	350 and Over	20	6	1	25
PVC (All Sizes)		6	1.8	3/8	9

END OF SECTION 230529

SECTION 230553 – IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.2 RELATED SECTIONS

A. Division 09 Section “Painting”: Identification painting.

1.3 REFERENCES

A. Division 01 Section “References”: Requirements for references and standards.

B. ASME A13.1 - Scheme for the Identification of Piping Systems.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.4 SUBMITTALS

A. Division 01 Section “Submittal Procedures.”

B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Samples: Submit two tags, 1-1/2 inches (38 mm) in size.

F. Samples: Submit two labels, 1.9 x 0.75 inches (48 x 19 mm) in size.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under Division 01 Section “Closeout Procedures.”

B. Record actual locations of tagged valves; include valve tag numbers.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Include valve tag chart.

1.7 REGULATORY REQUIREMENTS

A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

B. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturer: Seton Name Plate Company.

B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:
1. Manufacturer: Seton Name Plate Company.
2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches (38 mm) diameter.

B. Metal Tags:
1. Manufacturer: Seton Name Plate Company.
2. Brass with stamped letters; tag size minimum 1-1/2 inches (38 mm) diameter with smooth edges.

C. Information Tags:
1. Manufacturer: Seton Name Plate Company.
2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list in anodized aluminum frame with plexiglass cover.

2.3 STENCILS

A. Manufacturer: Seton Name Plate Company.

B. Stencils: With clean cut symbols and letters of following size:
1. Up to 2 inch (51 mm) Outside Diameter of Insulation or Pipe: 1/2 inch (13 mm) high letters.

2. 2-1/2 to 6 inches (64-150 mm) Outside Diameter of Insulation or Pipe: 1 inch (25 mm) high letters.
3. Over 6 inches (150 mm) Outside Diameter of Insulation or Pipe: 1-3/4 inches (44 mm) high letters.
4. Ductwork and Equipment: 1-3/4 inches (44 mm) high letters.

C. Stencil Paint: As specified in Division 09 Section "Painting", semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:
1. Manufacturer: Seton Name Plate Company.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Underground Pipe Markers:
1. Manufacturer: Seton Name Plate Company.
2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Manufacturer: Seton Name Plate Company.

B. Description: Steel with 3/4 inch (19 mm) diameter color coded head.

C. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers/Smoke Dampers: Red.
3. Plumbing Valves: Green.
4. Heating/Cooling Valves: Blue.

2.6 LABELS

A. Manufacturer: Seton Name Plate Company.

B. Description: Polyester, size 1.9 x 0.75 inches (48 x 19 mm), adhesive backed with printed identification.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:
1. Manufacturer: Seton Name Plate Company.
2. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches (184 x 76 mm).

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 Section “Painting” for stencil painting.

3.2 INSTALLATION

A. Division 01 Section “Quality Requirements”: Manufacturer's instructions.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Apply stencil painting in accordance with Division 09 Section “Painting.”

G. Identify items of mechanical equipment such as chillers, fans, terminal units, air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Tag automatic controls, instruments, and relays. Key to control schematic.

I. Identify all piping, concealed or exposed, with plastic pipe markers. Locate identification not to exceed 20 feet (6 m)on straight runs including risers and drops, at each branch and riser take-off, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 230553

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, Adjustment, and Balancing of Air Systems.

B. Testing, Adjustment, and Balancing of Hydronic Piping Systems.

C. Measurement of Final Operating Condition of HVAC Systems.

1.2 REFERENCES

A. AABC - National Standards for Total System Balance.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.3 SUBMITTALS

A. Submit name of Testing, Adjusting, and Balancing (TAB) Agency for approval within 14 days after award of Contract.

B. Design Review Reports:
   1. Review the Contract Documents, and indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

C. Preliminary Report Submittals:
   1. Prior to commencing work of this Section, and no more than 14 days after approval of TAB Agency submittals, submit report forms or outlines indicating adjusting, balancing, and equipment data required, with columns of design data filled in. By means of plan views, equipment profiles, and similar graphical descriptions, indicate where measurements will be taken.
   2. Submit the procedures to be used.

D. Field Reports: Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.

E. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

1.4 QUALITY ASSURANCE

A. Perform total system balance in accordance with National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.5 QUALIFICATIONS

A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience and certified by AABC or equivalent experience which would qualify for membership in these testing organizations

B. The approved Agency shall be in no way affiliated with the installing Subcontractor.

1.6 SEQUENCING

A. Sequence work under the provisions of Division 01 Section “Summary.”

B. Sequence work to commence after completion of systems or portions of work, and schedule completion of work before Substantial Completion of Project.

1.7 SCHEDULING

A. Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that systems are complete and operating correctly in accordance with sequence of operations before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Volume dampers are in place and open.
   7. Access doors are closed and duct end caps are in place.
   8. Air outlets are installed and connected.
   9. Duct system leakage is minimized.

B. Submit field reports. Report to the responsible Subcontractors, defects and deficiencies noted during performance of services which prevent system balance. Submit list of locations where the Contractor needs to provide additional balancing devices, beginning of work means acceptance of existing conditions.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. For belt driven equipment, provide sheave and belt modifications and/or replacements as required to ensure design flow rates as specified.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Adjust at minimum position and maximum position, and use manual dampers and actuator limit stops to minimize differences.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Coordinate with Division 23 Section "Instrumentation and Controls for HVAC" Temperature Controls for calibration of air handling units- static pressure sensors and determination of pressure setpoints.

M. Set pattern-control vanes and other devices in air inlets and outlets to provide the spread and throw patterns indicated, without objectionable noise or air motion to the occupants. Split the flow of linear slot diffusers in directions as required for good coverage. At completion, patterns shall be uniform and pleasing to the eye.

3.6 PROJECT CLOSEOUT

A. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Architect.

END OF SECTION 230593

SECTION 230713 – DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork insulation.

B. Duct Liner.

C. Fire Resistive Duct Wrap.

D. Insulation jackets.

1.2 RELATED SECTIONS

A. Division 09 Section “Interior Painting”: Painting insulation jackets.

B. Division 23 Section “Metal Ducts”: Glass fiber ductwork

C. Division 23 Section “Metal Ducts”: Duct liner.

1.3 REFERENCES

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

C. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

D. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

G. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

H. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).

I. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

K. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

L. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

M. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

N. NAIMA National Insulation Standards.

O. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

P. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Division 01 Section “Submittal Procedures”.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years’ experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.6 REGULATORY REQUIREMENTS

A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 and UL 723.

B. Insulation materials shall be asbestos free. No fibers with dimensions similar to asbestos fibers shall be released from any material.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.

B. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

C. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armacell (product: elastomeric foam insulation).

B. Ceel-Co (product: plastic jacket systems).

C. Certainteed Corporation.

D. Childers (products: metal jacket systems, and mastics).

E. Johns Manville.

F. Knauf.

G. Minnesota Mining and Manufacturing (3M) (product: fire-resistive duct blanket).

H. Nelson (product: fire-resistive duct blanket).

I. Nomaco K-Flex (product: elastomeric foam insulation).

J. Owens Corning.

2.2 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' ('Ksi') value: ASTM C518, 0.27 at 75EF (0.039 at 24EC).
   2. Maximum service temperature: 250EF (121EC) faced and 350EF (176EC) unfaced.
   3. Maximum moisture absorption: 0.20 percent by volume.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96; 0.02 perm.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

E. Tie Wire: Annealed steel, 16 gage (1.5 mm).

2.3 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.
1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75EF (0.036 at 24EC).
2. Maximum service temperature: 450EF (232EC).
3. Maximum moisture absorption: 1.0 percent by volume.
4. Density: 3.0 lb/cu ft (48 kg/cu m).

B. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, [black] [white] color.

2.4 ELASTOMERIC FOAM

A. Approved Products:
1. Armacell, AP Armaflex sheet insulation.
2. Nomaco K-Flex: Insul-Sheet S2S and K-Flex LS sheet insulation.

B. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
1. 'K' ('Ksi') value: ASTM C177; 0.277 Btu-in/(h-ft2-EF) at 75EF (0.04 W/m-K at 24EC).
2. Minimum service temperature: -70EF (-57EC) (flexible to -40EF (-40EC)).
3. Maximum service temperature: 220EF (104EC).
4. Maximum moisture absorption: ASTM C209, 0.2% by volume; or ASTM D1056, 5% by weight.
5. Moisture vapor transmission: ASTM E96; 0.08 perm-inches (0.116 ng/(s-m-Pa)).
6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.5 ELASTOMERIC FOAM DUCT LINER

A. Approved Products:
1. Armacell, AP Armaflex sheet insulation.
2. Nomaco K-Flex: Insul-Sheet S2S and K-Flex LS sheet insulation.

B. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
   1. 'K' ('Ksi') value: ASTM C177; 0.277 Btu-in/(h-ft2-EF) at 75EF (0.04 W/m-K at 24EC).
   2. Minimum service temperature: -70EF (-57EC) (flexible to -40EF (-40EC)).
   3. Maximum service temperature: 220EF (104EC).
   4. Maximum moisture absorption: ASTM C209, 0.2% by volume; or ASTM D1056, 5% by weight.
   5. Moisture vapor transmission: ASTM E96; 0.20 perm-inches (1.16x10-10 Kg/(s-m-Pa)).
   6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 Section “Project Management and Coordination”: Verification of existing conditions before starting work.

B. Verify that ductwork has been tested before applying insulation materials.

C. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Division 01 Section “Quality Requirements”: Manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Provide insulation for surfaces of new ductwork, as indicated and specified. Insulation values shall meet or exceed the requirements of ASHRAE 90.1-2001, State Energy Codes, and BOCA Energy Code requirements or Table I, whichever is greater.

D. Insulated Ductwork Conveying Air below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

E. Insulated Ductwork Conveying Air above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

F. Ductwork Exposed Mechanical Equipment Rooms or below 8 feet (2.4 meters) above finished floor in Finished Spaces: Provide glass fiber rigid insulation with vapor barrier jacket.

G. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
   6. Acoustical Duct Lining: Edges of lining exposed to the airstream and not protected by Zee Strips shall be coated with adhesive. Liner shall be neatly butted without gaps at transverse joints and shall be coated with adhesive at such joints. Cover raw insulation such that no fibers are released.
   7. Provide and install duct liner where:
      a. Indicated on the Drawings.
      b. Specified.
   8. Install duct liner in accordance with SMACNA standards.
   9. Install elastomeric foam duct liner in accordance with manufacturer-s recommendations.
   10. Liner shall be folded and compressed in the corners of rectangular duct sections or shall be cut and fit to assure butted edge overlapping. Longitudinal joints in duct liner shall not occur except at the corners of ducts unless the size of the duct and standard liner product dimensions make such necessary.
   11. Coat longitudinal joints in liner with adhesive.
   12. Metal nosings that are either channel or zee profile or are integrally-formed from the duct wall shall be securely installed over transversely oriented liner edges facing the airstream at fan discharge, at any interval of lined duct preceded by unlined duct and on upstream edges of liner at every transverse joint.
   13. Where dampers, turning vane assemblies or other devices are placed inside of lined duct or fittings, the installation shall not damage the liner or cause erosion of the liner. The use of metal hat sections or other buildout means is optional; when used, buildouts shall be secured to the duct wall with bolts, screws, rivets or welds.
   14. Liner shall also be installed with mechanical fastening devices meeting the following additional requirements:
      a. Are spaced in accordance with SMACNA Guidelines.
      b. When installed, are as corrosion-resistant as G60 coated galvanized steel.
      c. Will not adversely affect the fire-resistant classification of liner and adhesives.
      d. Do not damage the liner when applied as recommended by the manufacturer.
      e. Do not cause leakage in the duct.

f. Do not project more than nominally into the airstream.

g. Will indefinitely sustain a 50 lb. (222 N) tensile dead load test perpendicular to the duct wall.

h. Are the correct length for the specified liner thickness.

I. Inspection Plates and Test Holes: Provide, where required, in ductwork or casings for balance measurements. Test holes shall be factory fabricated, airtight, and noncorrosive with screw cap and gasket. Extend cap through insulation.

J. Install insulation after ductwork and equipment have been tested and approved.

K. Ensure that surface is clean and dry prior to installation. Ensure that insulation is dry before and during application. Finish with system at operating conditions.

L. Ensure that insulation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation material, properly sealed.

M. Finish insulation neatly at hangers, supports and other protrusions.

N. Locate insulation or cover seams in least visible locations.

O. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

P. Do not insulate exposed ductwork in conditioned spaces or ductwork that is acoustically lined, unless otherwise specified or indicated on the Drawings.

Q. Wherever exposed ductwork for air conditioned systems passes through non air conditioned spaces, insulate ductwork with glass fiber rigid insulation with vapor barrier, to prevent condensation.

R. Standing seams, supporting angles and flanges on insulated ductwork shall be insulated with thickness equal to the duct and edges shall be finished and vapor sealed.

S. Mechanical fasteners shall not be riveted or screwed to the duct and shall not penetrate the metalwork.

T. For supply or return ductwork which is required to be insulated, insulation shall be continuous and shall include the insulating of register, grille and diffuser connection plenums/boots.

3.3 PAINTING AND IDENTIFICATION

A. Paint in accordance with Division 09 Section “Interior Painting.”

3.4 FIELD INSPECTION

A. Visually inspect to ensure that materials used conform to Specifications. Inspect installations progressively for compliance with requirements.

TABLE I
DUCTWORK INSULATION MATERIAL AND WALL THICKNESS

DUCTWORK TYPE	INSULATION MATERIAL	VAPOR BARRIER REQUIRED	INSULATION WALL THICKNESS
Exhaust ductwork from exterior building openings (such as louvers and roof hoods) to 4 feet (1.2 m) interior of motorized damper or backdraft damper	Glass Fiber, Flexible (only if ductwork is concealed)	Yes	2" (38.1 mm)
	Glass Fiber, Rigid	Yes	1" (25.4 mm)
Supply ductwork for heating and cooling systems with heating supply air temperatures greater than or equal to 100EF	Glass Fiber, Flexible	Yes	2" (50.8 mm)
	Glass Fiber, Rigid	Yes	2 layers of 1" (25.4 mm) with staggered joints
Exposed supply ductwork for cooling systems that pass through non air-conditioned spaces	Glass Fiber, Rigid	Yes	1" (25.4 mm)
Exposed supply ductwork in mechanical or equipment rooms	Glass Fiber, Rigid	No for heating only systems, Yes for cooling systems	1" (25.4 mm)
Transfer ducts	Glass Fiber Duct Liner, Rigid	--	1" (25.4 mm)
Ductwork 10 feet upstream and downstream from a fan, or through the first elbow, whichever is longer (excluding fresh air intake ductwork and ductwork within 10 feet downstream of a cooling coil or humidifier).	Glass Fiber Duct Liner, Rigid	--	1" (25.4 mm)
Ductwork indicated on Drawings and herein specified to be acoustically lined	Glass Fiber Duct Liner, Rigid	--	1" (25.4 mm)

END OF SECTION 230713

SECTION 230900 – INSTRUMENTATION AND CONTROLS 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, apply to this Section.

1.2 SUMMARY

A. The intent of this specification is to expand on the buildings existing automatic temperature controls system.

B. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

C. Related Sections include the following:
   1. Division 23 Section “Common Motor Requirements for HVAC Equipment” for requirements that relate to this section.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks that interface to existing Honeywell EBI system.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
   1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
   2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
   3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
   4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.

5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
    a. Space Temperature: Plus or minus 1 ºF (0.5 deg C).
    b. Ducted Air Temperature: Plus or minus 1 ºF (0.5 deg C).
    c. Outside Air Temperature: Plus or minus 2 ºF (1.0 deg C).
    d. Temperature Differential: Plus or minus 0.25 ºF (0.15 deg C).
    e. Airflow (Terminal): Plus or minus 10 percent of full scale.
    f. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
    g. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
    h. Electrical: Plus or minus 5 percent of reading.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.
8. DDC System Hardware:
    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:
    a. Schematic diagrams of each controlled system with control points labeled and control

elements graphically shown, with wiring.

b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.

c. Written description of sequence of operation including schematic diagram.

d. Points list.

C. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

D. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

E. Qualification Data: For Installer and manufacturer.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of setpoints.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

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 ASHRAE 135 for DDC system components.

1.7 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.

1.8 COORDINATION

A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 26 Section "Fire Alarm Systems" to reuse the existing Fire Alarm System as allowable, augmented with compatibility fully capable to interface new and existing equipment with that system.

C. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

1.9 SPARE POINTS

A. Provide a minimum of 10% spare points or 16 spare points, whichever is greater, in each DDC control panel for future use. Spare points shall be equally distributed among analog input, analog output, digital input and digital output. It is not intended that spare points be provided in unitary control panels which serve ventilation, VAV boxes, and fan coil units. It is intended that spare points be provided in master control panels and in panels which serve boiler/mechanical rooms and major equipment such as air handling units and chillers.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Manufacturers:
   1. Trane
   2. No Substitutions.

B. Control system shall consist of sensors, indicators, actuators, automatic control valves, motorized dampers, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

C. Control system shall include the following:
   1. Fire alarm system specified in Division 26 Section "Fire Alarm Systems."

2.3 DDC EQUIPMENT

A. Operator Workstation: N/A

B. Local Control Unit: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
   1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
   3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
   4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
   1. Binary Inputs: Allow monitoring of on-off signals without external power.
   2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
   3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
   4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
   5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
   6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
   7. Universal I/Os: Provide software selectable binary or analog outputs.

D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
   1. Output ripple of 5.0 mV maximum peak to peak.
   2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
   3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
   1. Minimum dielectric strength of 1000 V.
   2. Maximum response time of 10 nanoseconds.
   3. Minimum transverse-mode noise attenuation of 65 dB.
   4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

F. Uninterruptible Power Supply: Provide UPS to maintain power to DDC system during periods of power loss before generator or normal power is restored.

2.4 UNITARY CONTROLLER

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
   1. Configuration: Diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
   2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
   3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
   4. Enclosure: Dustproof rated for operation at 32 to 120 ºF (0 to 50 deg C).

2.5 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable setpoint, scale range minus 10 to plus 70 ºF (minus 23 to plus 21 deg C), and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
   1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
   1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig (21 to 90 kPa).
   2. Proportional band shall extend from 2 to 20 percent for 5 psig (35 kPa).
   3. Authority shall be 20 to 200 percent.
   4. Air-supply pressure of 18 psig (124 kPa), input signal of 3 to 15 psig (21 to 103 kPa), and output signal of zero to supply pressure.

2.6 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:
1. Accuracy: Plus or minus 0.5 ºF (0.3 deg C) at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 18 inches (460 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
4. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible ; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: Concealed.
   b. Set-Point Indication: Concealed.
   c. Thermometer: Exposed.
7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. Pressure Transmitters/Transducers:
1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
   d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).
2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

2.7 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered

transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.8 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
   1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
   4. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
   5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
   6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   1. Manufacturers:
      a. Belimo Aircontrols (USA), Inc.
   2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
   3. Dampers: Size for running torque calculated as follows:
      a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
      b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
      c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
      d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
      e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of

1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.

f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24, 120, or 230-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: Minus 22 to plus 122 ºF (Minus 30 to plus 50 deg C).
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 ºF (Minus 30 to plus 121 deg C).
12. Run Time: 30 seconds open, 30 seconds closed.

2.9 AUTOMATIC DAMPERS

A. Manufacturers:
1. Ruskin.
2. Arrow.
3. Greenheck.
4. American Warming & Ventilating.

B. Provide automatic control dampers not specified to be integral with other equipment.

C. Dampers shall be ultra-low leakage type, with blade edges fitted with replaceable inflatable seals to limit damper leakage to 6 CFM per square foot at 1 in. w.g. Side seals shall be stainless steel of the tight-seal spring type.

D. Dampers in Galvanized Steel Ductwork:
1. For applications not exceeding 36 inches blade length in an individual section, 1,500 fpm face velocity, 2.5 in. w.g. total system static pressure, and 180 F operating temperature, dampers shall be equal to Ruskin model CD-36, low leakage type with roll-formed blades. Blades shall be not less than 16-gauge (1.6 mm) galvanized steel, with PVC-coated polyester fabric edge seals mechanically locked into blade edges.
2. For applications exceeding any of the criteria listed above, dampers shall be equal to Ruskin model CD-60, low leakage type with high-performance airfoil blades. Blades shall be double-skin construction of 14 gauge (2.0 mm) equivalent thickness, with extruded Ruskiprene (TPR) (or equal) blade edge seals locked into blade edges. Dampers shall be suitable for 60 inches maximum single-section width, 6,000 fpm face velocity, up to 11 in. w.g. static pressure (8.5 in. w.g. total system pressure requires maximum section width of 36 inches), and operating temperature range of -72 F to 275 F
3. Frames shall be not be less than 13-gauge (2.28 mm) galvanized steel, or shall be fabricated of 16-gauge (1.6 mm) galvanized steel hat channel reinforced with corner braces for structural strength equal to 13-gauge channel frames.

E. Dampers in Aluminum Ductwork:
1. Dampers shall be equal to Ruskin CD-50, low leakage type with high-performance airfoil blades. Blades shall be heavy-gauge extruded aluminum, with extruded Ruskiprene (TPR)

(or equal) blade edge seals locked into blade edges. Dampers shall be suitable for 60 inches maximum single-section width, 6,000 fpm face velocity, up to 11 in. w.g. static pressure (8.5 in. w.g. total system pressure requires maximum section width of 36 inches), and operating temperature range of -72 F to 275 F

2. Frames and blades shall be of 6063T5 aluminum alloy. Frames shall have minimum wall thickness of 0.125 inches.

F. Blades shall not be over 8 inches wide. Bearings shall be oilite, stainless steel sleeve, ball-bearing, or nylon. Blade axles shall be ½" plated steel hex rods. Control shafts shall be ½" diameter, 6 inches long, removable. Multiple-section dampers shall have factory-installed jackshafts.

G. Frames channels shall not exceed 1-inch high for damper heights over 12 inches, and shall not exceed 1/2-inch high for damper heights 12 inches and less.

H. Proportional control dampers shall be opposed blade type; two-position dampers shall be parallel blade type.

I. Dampers shall be fabricated of materials that are similar to the ductwork in which they are installed. Provide non-electrically-conductive material between dissimilar metals.

J. Dampers that are located in outside walls or in roof line that are 10 sq ft or larger shall be insulated. Dampers shall be equal to Tamco Series 9000, thermally insulated dampers.

K. Automatic dampers at exterior wall louvers shall be 4 inches shorter in size than the louver they serve.

2.10 FAIL SAFE POSITION

A. Unless otherwise indicated, actuators shall be spring loaded and shall, upon a loss of power, actuate their device to an appropriate "fail safe" position.
   1. Hot water valves - fail safe to fully open.
   2. Outside and exhaust air dampers - fail safe to fully closed.
   3. Exhaust fan motorized dampers - fail safe to fully closed.
   4. Return air dampers - fail safe to fully open.

PART 3 - SEQUENCE OF OPERATION

3.1 ALARMS

A. System shall generate at minimum to Generate Alarms, Complete with Individualized per Point Alarm Message for the Following Conditions:
   1. High temperature (85•F) and low temperature (below 50•F) for each typical room

temperature sensor.
2. Fan failure on air handling units AHU-1.
3. High and low static pressure for AHU-1.
4. Domestic water low water temperature.

B. Alarms shall be disabled when their associated system has been disabled as part of a standard control function. For example, when boilers are commanded off during the summer months and boiler water temperature drops below the low boiler water temperature alarm setpoint, an alarm shall not be generated.

3.2 HEATING/COOLING MODE

A. Heating Mode:
1. Heating mode is automatically enabled when outside air temperature drops below 60 ºF or when there is a call for heating from any space. Heating mode is automatically disabled when the outside air temperature rises above 60 ºF

B. Cooling mode is enabled by the DDC system when there is a call for mechanical cooling.

C. Provide manual override points on the graphics screen to allow the Owner to override the automatic heating and cooling modes.

D. Domestic Hot Water
1. The electric water heater shall be stand alone. Graphics terminal to be capable to monitor and alarm domestic water temperature (solar water as alternate circulating pump) and hot water return pump shall be included on graphics screen.

3.3 EXHAUST FANS

A. The following fans will be switched on/off by the DDC system on a programmed basis to keep the spaces ventilated. When the fan is commanded on, the fan's motorized damper shall open. Upon closure of the damper auxiliary switches, the fan starts. When the DDC commands the fan off, the damper shall close.

B. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:
1. Exhaust fan on/off command
2. Exhaust fan airflow status
3. Fan alarm status
4. Space temperature where required
5. Space setpoint where required

3.4 INTERFACE WITH FIRE ALARM SYSTEM SHUT DOWN

A. For starters that are associated with equipment that is required to be shut down upon a fire alarm condition, provide input contacts within the starter enclosure to interface with existing building’s fire alarm system. Upon receipt of a signal from the building(s fire alarm system, power to load side of the starter is turned off. Circuitry is provided to ensure that power is off whether the starter

is in the “AUTO”, “HAND” or “BYPASS” mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements of Division 26.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

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 control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:
1. Division 23 Section "Instrumentation and Controls for HVAC" for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

A. DDC: Direct digital control.

1.4 AIR-HANDLING-UNIT CONTROL SEQUENCES

A. Fan control: The supply fan shall run continuously.

B. Occupied mode: The 2 position outdoor air damper shall open to its operating position.

C. Unoccupied: The dampers shall be positioned for 0% outdoor air.

D. Heating mode: The modulating gas fired heat exchanger to maintain leaving air temperature set point for 55 ºF (adjustable).
1. Hydronic duct mounted reheat coil 2-way modulating control valve shall maintain room temperature 72F (adjustable).

E. Cooling mode: The compressors shall be staged on and off in response to the space temperature set point. Cooling set point shall be initially set for 74 ºF (adjustable).

F. Economizing:
1. When outdoor enthalpy is below indoor enthalpy, economizing shall be the first stage of cooling. Upon call for economizer cooling, the power exhaust fan shall be commanded on.

1.5 EXHAUST FAN

A. When the fan respective air handler is placed in the occupied mode of operation, the fan's motorized damper opens and the fan is commanded on upon closure of the damper auxiliary switch. When the air handler is in placed in the unoccupied mode the fan is commanded off and its respective motorized damper shall close. Configure controls to allow control and override of these fans through the operator workstation graphics:
1. EF-1

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal Ductwork.

B. Nonmetal Ductwork.

C. Casing and Plenums.

D. Kitchen Hood Ductwork.

E. Air Duct Leakage Tests.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1.3 RELATED SECTIONS

A. Division 23 Section “Testing, Adjusting and Balancing for HVAC.”

B. Division 09 Section “Interior Painting”: Weld priming, weather resistant, paint or coating.

C. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment”: Sleeves

D. Division 23 Section “Duct Insulation”: External insulation and duct liner.

E. Division 23 Section “Air Duct Accessories.”

F. Division 23 Section “Air Outlets and Inlets.”

1.4 REFERENCES

A. ASTM A 36 - Structural Steel.

B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.

E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

F. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.

J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

K. ASTM C 14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

L. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

M. AWS D9.1 - Welding of Sheet Metal.

N. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment.

O. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

P. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

Q. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

R. SMACNA - HVAC Air Duct Leakage Test Manual.

S. SMACNA - HVAC Duct Construction Standards - Metal and Flexible (SMACNA HVACDCS).

T. SMACNA - Fibrous Glass Duct Construction Standards.

U. UL 181 - Factory-Made Air Ducts and Connectors.

1.5 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.6 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures”.

B. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for 4 inch (1000 Pa) pressure class and higher, and kitchen hood exhaust systems.

C. Product Data: Provide data for duct materials, duct liner and duct connectors.

D. Test Reports: Submit testing apparatus, procedures, and preliminary forms prior to performing

tests. On final reports, indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Indicate additional fittings used.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA HVACDCS.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing the work of this section with minimum three years experience.

1.10 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 standards.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flexible Ducts:
   1. Flexible Technologies - Thermaflex product line.
   2. Buckley - Flexmaster Buck Duct product line.

B. Plastic Drawbands:
   1. Panduit.
   2. Thomas and Betts.
   3. Tyton.

C. Tape for Flexible Ducts:
   1. Ideal Tape Co., Inc.
   2. Fasson.

3. Minnesota Mining and Manufacturing (3M).
4. Nashua.
5. Shurtape.
6. Venture.

D. Sealants:
1. Hardcast.
2. Ductmate.
3. Eco.
4. Foster.
5. Polymer Adhesive Sealant Systems.
6. United McGill.

E. Manufactured Ductwork - Round and Flat Oval:
1. United McGill.
2. Monroe Metal Mfg. Co.
3. Semco.

F. Manufactured Ductwork - Transverse Duct Connection System:
1. Ductmate.

2.2 MATERIALS

A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90. Provide paint-grip exterior surfaces for exposed ducts.

B. Steel Ducts: ASTM A366, A569 and A568.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

D. Insulated Flexible Ducts:
1. Fabric-Core Flexible Ductwork:
a. Thermaflex Model M-KC.
b. UL 181, Class 1, heavy fiberglass cloth fabric supported by helically wound spring steel wire; fiberglass insulation; reinforced metalized vapor barrier film..
c. Pressure Rating: 10 inches WG (2.5 kPa) positive and 2.0 inches (500 Pa) negative.
d. Maximum Velocity: 6000 fpm (30.4 m/sec).
e. Temperature Range: -20EF to 250EF (-28EC to 121EC).

E. Drawbands for Flexible Ducts:
1. Stainless Steel: 1/2-inch (13 mm) wide with screw-driven worm gear.
2. Plastic: Panduit PLT5H or PLT8H; Thomas and Betts Dukt-Rap, VAL-26-50, or VAL-275X-25; or Tyton T150L or LX. Install with manufacturer=s lever-action tightening tool.

F. Tape for Flexible Ducts: Ideal-Seal 587A/B, UL 181B-FX, aluminum foil with pressure-sensitive acrylic adhesive, -20EF to 250EF (-28EC to 121EC) temperature range.

G. Stainless Steel Ducts: ASTM A167, Type 304. Material for exposed ducts shall have a finish at least equal to Mill Polished No. 4.

H. Fasteners: Rivets, bolts, or sheet metal screws.

I. Sealants: See Duct Sealant portion of this Specification.

J. Hanger Rod: ASTM A36; galvanized steel; threaded both ends, threaded one end, or continuously threaded.

K. Wire Rope Hanging System: At the Contractor=s option, Ductmate Industries= Clutcher and EZ-Lock hanger system may be used with Ductmate wire rope (no substitutions). System use and installation shall conform with manufacturer=s requirements. System shall not be painted or otherwise coated. System shall not be used in corrosive environments. Not to be used on ducts in mechanical rooms or 50' -0" of duct run out of mechanical rooms.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVACDCS, as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Construct Tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide single wall, 16 ga turning vanes. Do not use air foil turning vanes.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

F. Longitudinal locks or seams known as Abutton-punch-snap-lock@ will not be permitted.

G. Exposed Ducts: Select and handle materials with care for a neat appearance. Joint connections on round and flat oval ducts shall be sleeve or flanged type; drawbands are not acceptable.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufactured ductwork and fittings listed below are acceptable alternatives to standard ductwork systems.

B. Manufacture in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

C. Transverse Duct Connection System: SMACNA "E" rated rigidity class connection, interlocking

angle and duct edge connection system with sealant, gasket, cleats, and corner clips. Product shall be Ductmate or equal.

D. Exposed Ducts: Select and handle materials with care for a neat appearance. Joint connections on round and flat oval ducts shall be sleeve or flanged type; drawbands are not acceptable.

2.5 CASINGS

A. Fabricate casings in accordance with SMACNA HVACDCS and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch (100 mm) high concrete curbs. At floor, rivet panels on 8 inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of 18 gauge (1.20 mm) galvanized expanded metal mesh supported at 12 inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge (1.50 mm) back facing and 22 gauge (0.80 mm) perforated front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (75 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber media, on inverted channels of 16 gauge (1.50 mm).

2.6 PRESSURE CLASSIFICATION

A. Ratings as indicated on the Drawings or as specified.

B. If no ratings are indicated, ductwork shall be rated for the external static pressure of the system plus twenty-five percent.

2.7 DUCT SEALING

A. Seal ductwork as outlined in the SMACNA HVACDCS. Seal ductwork to a minimum of class A (transverse joints, longitudinal seams, and duct wall penetrations) in accordance with procedures as outlined in the manual.

B. Seal ductwork systems as required to ensure that maximum duct leakage does not exceed that allowed by the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. Allow sealant to dry in accordance with manufacturer-s requirements of time and environmental conditions before ductwork systems are pressurized.

C. Duct sealing materials used shall be non-flammable and non-combustible in both liquid and solid states.

D. Seal exposed ducts by applying mastic-type or gasket-type sealer just before the joint or seam is made; remove excess sealant for a neat appearance.

E. Materials for Sealing:

1. Hardcast gypsum-based tape and mastic, waterproof type when used on moist-air exhaust or in humid or outdoor locations.
2. Hardcast Flex Grip mastic.
3. Ductmate flanged lateral joints with gaskets.
4. Ductmate PROseal.
5. Eco 4450 (red color)
6. Or approved equal.

2.8 UNIFORMITY OF MATERIALS

A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, shall be fabricated of materials that are similar to the ductwork in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install ducts in accordance with SMACNA HVACDCS.

C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. “Fishmouth” duct connections shall not be allowed.

E. Exposed Ducts: Handle with care for a neat appearance. Repair or replace dented or damaged ductwork as required by the Architect. Select hangers for appearance, and to prevent sagging or distortion of duct.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports. Strap hangers shall be minimum 16-gauge (1.50 mm) x 1-inch (25 mm) galvanized straps. Hanger and support components including but not limited to Aunistrut@ shall be galvanized steel except that where other duct materials are used, the hanger materials shall be compatible and non-corrosive to the duct. Wire hangers are not acceptable.

J. Flexible Ducts:
   1. Connect diffusers or light troffer boots to low pressure supply ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.
   2. Minimum bend radius shall be one and one half times the duct diameter. Support the bend to maintain this radius.
   3. Bends shall not exceed 45 degrees.
   4. Connect flexible ducts to metal ducts with 2 turns of duct tape and metal draw bands. Plastic draw bands will not be accepted. Plastic drawbands may be used if they are installed using the band manufacturer-s lever-action tightening tool. On insulated flexible ducts, provide an additional seal of tape and drawband on the insulation-s vapor barrier.

K. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

L. Protect ductwork from contamination. Protection and cleaning shall be performed in accordance with SMACNA Duct Cleanliness Guidelines – Advanced Levels. in During transport to the site and the construction period, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Seal open ends of completed and “in-progress” ductwork. During installation, [protect ductwork with surface wrapping. Store ductwork in clean dry, conditions and keep sealed. Interior surfaces must be wiped down immediately prior to installation. Do not start ducted air moving equipment until construction is completed to a stage where airborne construction dust is no longer present. At the time of substantial completion, the entire air distribution system shall be turned over to the owner clear of construction dust and debris. If the interior surfaces of any ducted air moving equipment or the interior surfaces of any portion of the ductwork distribution system are found, as determined by the Architect, to contain significant construction dust and debris, the entire air distribution system shall be cleaned in accordance with Division 23. If proper precautions are taken to prevent construction dust and debris from entering the ductwork during construction and if the Architect finds all ductwork to be free from such dust and debris, air duct cleaning shall not be required. Contractor shall provide documentation that cleanliness guidelines and internal wipe down of ductwork was completed.

M. Install duct-mounted components furnished under other Sections of this Specification, such as control dampers and control sensors and smoke detectors. Install with straight lengths of duct as required for proper operation. Provide access at such components as required. Install in accessible locations for maintenance; notify the Architect if a location indicated or selected requires addition of access by other trades.

3.2 AIR DUCT LEAKAGE TESTS

A. Perform air duct leakage tests in accordance with the testing procedures outlined in the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual.

B. Leakage testing shall be performed on complete ductwork including fittings and accessories such as dampers, access doors, branch connections, and inlets and outlets. Flexible ducts and air handling units may be excluded. Ducts may be temporarily sectioned and capped for testing, for reasons of limited test apparatus capacity, or requirements of construction phasing.

C. Leakage tests, including retests as required, shall be performed prior to concealment and insulation.

D. The Following Duct Systems Shall Be Tested for Leakage, regardless of whether or not SMACNA recommends testing:
   1. Ductwork.
   2. Supply ductwork from fan outlets to inlets of VAV boxes and reheat coils.
   3. Return ductwork from fan inlets to points where ductwork serves less than 3 return registers and/or grilles.

E. Submit testing apparatus, procedures, and preliminary forms prior to performing tests.

F. Once leakage tests are complete, submit leakage test report. Leakage test report forms shall include the following:
   1. Project and system identification data
   2. Description of ductwork under test
   3. Leakage class specified
   4. Test pressure specified
   5. Duct construction pressure class
   6. Duct design air flow
   7. Surface area of ductwork under test
   8. Maximum allowable leakage factor
   9. Calculated allowable leakage
   10. Test apparatus
      a. Blower
      b. Orifice, tube size
      c. Orifice size
      d. Orifice coefficient
      e. Calibration date
   11. Test orifice differential pressure
   12. Leakage for tested section
   13. Total leakage for system
   14. Date of test
   15. Witnesses

G. Air duct leakage testing shall be performed by an experienced agency that is independent of the Testing, Adjusting and Balancing (TAB) Agency specified in Division 01 - Testing, Adjusting and Balancing.

H. The TAB Agent shall witness the duct leakage tests performed under Division 23. At a minimum, the first duct leakage test shall be witnessed and approved by the TAB Agent and the Engineer. At a minimum, subsequent duct leakage tests shall be witnessed and approved by the TAB Agent and the owner's representative. The TAB Agent shall confirm proper testing procedures and shall give written approval of the leakage tests. If deficiencies are discovered, the TAB agent shall document these deficiencies to the Contractor and the Engineer. Once deficiencies are corrected, the TAB Agent shall witness follow-up leakage tests.

I. Coordinate with TAB Agency and receive written sign-off of the leakage tests by the TAB Agent prior to submitting leakage test report.

J. Leakage Class Schedule

DUCT PRESSURE CLASS	DUCT TYPE	LEAKAGE CLASS
1/2", 1", 2" W.G.	Rectangular Metal	12 [24 for seal class B]
1/2", 1", 2" W.G.	Round Metal	6 [12 for seal class B]
3" W.G.	Rectangular Metal	6
3" W.G.	Round Metal	3
-10” W.G.	Round Metal	

3.3 SCHEDULES

A. Ductwork Material Schedule

AIR SYSTEM	MATERIAL
Low Pressure Supply (Heating Systems)	Galvanized Steel, Aluminum,
Low Pressure Supply (System with Cooling Coils)	Galvanized Steel, Aluminum,
Medium and High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Locker Room Exhaust	Aluminum, Stainless Steel
Kitchen Hood Exhaust	Steel, Stainless Steel
Dishwasher Exhaust	Aluminum, Stainless Steel, Glass
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Fume (Lab) hood Exhaust	Stainless Steel
Engine Exhaust	Steel

B. Ductwork Pressure Class Schedule

AIR SYSTEM	SMACNA PRESSURE CLASS
Supply (Heating Systems)	3 inch
Return and Relief	2 inch
General Exhaust	1 inch (250 Pa)
Locker Room Exhaust	1 inch (250 Pa)
Dishwasher Exhaust	1 inch (250 Pa)
Fume Hood Exhaust	3 inch (750 Pa)
Outside Air Intake	2 inch (500 Pa)
Combustion Air	1/2 inch (125 Pa)
Engine Exhaust Metal Shop	-10 inch

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct Access Doors.

B. Duct Test Holes.

C. Flexible Duct Connections.

D. Volume Control Dampers.

E. Duct Sleeves, Prepared Openings and Closure Collars

F. Turning Vanes and Spin-in Fittings

G. Welding fume exhaust device

1.2 RELATED SECTIONS

A. Division 23 Section “Metal Ducts.”

B. Division 26 “Electrical”: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. NFPA 92A - Smoke Control Systems.

C. NFPA 70 - National Electrical Code.

D. SMACNA - HVAC Duct Construction Standards - Metal and Flexible (HVACDCS).

E. SMACNA - Seismic Restraint Manual - Guidelines for Mechanical Systems (SRMGMS).

F. UL 33 - Heat Responsive Links for Fire-Protection Service.

G. UL 555 - Fire Dampers and Ceiling Dampers.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

C. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of access doors and test holes.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section “Product Requirements.”

B. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Dampers:
1. Ruskin.
2. Air Balance, Inc.
3. Arrow.
4. Cesco.
5. Greenheck.
6. NCA.
7. Prefco.
8. Tamco.
9. Vent Products, Inc.

B. Duct Access Doors:
1. Ruskin.
2. Air Balance, Inc.
3. Arrow.
4. Cesco.
5. DuctMate.

6. Greenheck.
7. NCA.
8. Prefco.
9. Vent Products, Inc.

C. Flexible Connectors and Duct Test Holes:
1. Ductmate.
2. Ventfabrics.
3. Duro-Dyne.

D. Locking Quadrants for Shop-Fabricated Volume Dampers:
1. Ventfabrics.

2.2 BACKDRAFT DAMPERS

A. Multi-Blade, Parallel Action Gravity Backdraft Dampers: Frames of 16 gauge (1.5 mm) thick galvanized steel, or extruded aluminum, with blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball or sintered bronze bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure. Pressure and velocity ratings shall be suitable for the application.

2.3 DUCT ACCESS DOORS

A. Fabricated in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings. Standard access doors may be shop-fabricated. Pressure rating shall be equal to the rating of the associated ductwork.

B. Fabrication: Removable, with retainer chain. Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1 inch (25 mm) thick insulation with galvanized steel sheet metal airstream-side cover.
1. Less Than 12 inches (300 mm) Square: Secure with sash locks.
2. Up to 18 inches (450 mm) Square: Provide two hinges and two sash locks.
3. Larger Sizes: Lift-out hinges and two compression latches [with outside and inside handles].
4. Clamping-type doors with knob handles, as manufactured by Ductmate, may be substituted for standard sizes.

C. Medium- and High-Pressure Positive-Pressure Ducts: Ruskin ADHP-3 high pressure access door rated up to 12 in. WG (2985 Pa), with spring latches to allow the door to open temporarily to relieve negative pressures.

D. Access Doors For Grease Duct Applications:
1. Ductmate Industries, Inc. HI-TEMP access door, or approved equal.
2. Meet NFPA 96 requirements for use in grease duct systems.
3. 16 gauge (1.61 mm) black iron backing plate.
4. High temperature ceramic gasket, 2300EF (1260EC) maximum.
5. Zinc plated conical springs, zinc coated wing nuts and zinc plated carriage bolts.

E. Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings.

B. Connector: Fabric crimped into metal edging strip.
1. Connectors shall be Ductmate PROFLEX or approved equal.
2. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
3. Net Fabric Width: Approximately 6 inches (150 mm) wide.

C. Metal: 3 inch (75 mm) wide, 24 gauge (0.6 mm thick) galvanized steel.

D. Connectors shall have double fold seams. Single fold seams (metal folded once only) shall not be accepted.

2.6 DUCT SLEEVES, PREPARED OPENINGS AND CLOSURE COLLARS

A. Duct Sleeves and Closure Collars: Fabricate from minimum 20-gauge (1.0 mm) galvanized steel. Where sleeves are installed in bearing walls, provide structural steel sleeves.

B. Prepared Openings: Provide one-inch clearance between the duct and the sleeve.

C. Closure Collars: Fabricate from minimum 20-gauge (1.0 mm) galvanized steel.

2.7 TURNING VANES AND SPIN-IN FITTINGS

A. Factory-fabricated and factory-or-field-assembled units consisting of curved turning vanes for uniform air distribution and change of direction with minimum turbulence and pressure loss. Provide curved single thickness vanes for square elbows, conforming to SMACNA HVACDCS single vane schedule for small vanes. Each vane shall form a 90-degree arc. Fill the entire duct cross-section with vanes. Orient leading edge of vanes parallel to the side of the duct (directed straight into the entering airstream). Turning vanes shall be minimum 16 gauge (1.61 mm), regardless of gauges that are recommended by SMACNA. Double thickness turning vanes are not allowed.

B. For round ducts taking off from rectangular ducts, provide factory fabricated, galvanized sheet metal, spin-in fittings with conical or bellmouth taps. 45 degree rectangular-to-round branch fittings may be substituted for spin-ins.

2.8 UNIFORMITY OF MATERIALS

A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, shall be fabricated of materials that are similar to the ductwork in which they are installed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVACDCS. Refer to Division 23 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before filters, before and after coils, before and after fans, before automatic dampers, at fire dampers, at smoke dampers, at combination fire and smoke dampers, at smoke detector sampling tubes (upstream of the sampling tube), at multiple blade volume dampers and elsewhere as specified or as indicated on the drawings. Provide at changes in direction of kitchen exhaust ductwork and as otherwise required for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450 mm) size for shoulder access, and as specified or as indicated on the drawings. Review locations prior to fabrication.

D. Access doors installed for access to fire dampers shall be provided with identification labels with letters of minimum 2 inch (13 mm) height to indicate the presence of fire protection devices within. Refer to specification Section 250553 for labeling materials specifications.

E. Provide duct access doors in horizontal return air, exhaust air and fresh air intake ductwork to facilitate the removal of accumulations of dust and combustible materials in accordance with NFPA 90A. Install access doors at maximum 20 foot (6 m) intervals and at the base of each vertical riser.

F. Provide duct test holes where indicated and required for testing and balancing purposes.

G. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated and required, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

H. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

I. Demonstrate operation and re-setting of each fire damper to Owner's representative.

J. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and support by vibration isolators. Staple and seal connections airtight.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

L. Use splitter dampers only where indicated.

M. Provide balancing dampers on high velocity systems where indicated. Refer to Division 23 Section "Air Terminal Units."

N. Provide balancing dampers on duct take-offs to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. Where branch duct is completely above non-accessible wallboard ceiling and the Architect has not approved the use of access doors, duct mounted balancing dampers shall not be required.

O. For volume dampers located above suspended ceilings and in areas that are not visible to building occupants (e.g. mechanical rooms), provide fluorescent orange colored surveyors tape. Permanently attach tape to damper handles and run tape down to 10 in. (254 mm) above ceiling or 12 in. (304 mm) below damper handle where ceilings do not exist (e.g. mechanical rooms).

P. Duct Sleeves and Prepared Openings: Install for ducts passing through roofs, ceilings, walls and floors. Field determine the proper size and location of sleeves and prepared openings.
   1. Duct Sleeves: Allow one-inch (25 mm) clearance between duct and sleeve or one-inch (25 mm) clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.
   2. Prepared Openings: Allow one-inch (25 mm) clearance between duct and opening or one-inch (25 mm) clearance between insulation and opening for insulated ducts, except at grilles, registers, and diffusers.

Q. Closure Collars:
   1. Provide not less than 4 inches (100 mm) wide on each side of walls or floors where sleeves or prepared openings are installed. Fit collars snugly around ducts. Grind smooth edges of collar to prevent tearing or puncturing insulation covering or vapor barrier.
   2. Where insulated ducts penetrate non-fire-rated walls, insulation shall be continuous through the closure collars and the closure collars shall be installed tight to the insulation.
   3. Where insulated ducts penetrate fire rated walls, insulate ducts on both sides of closure collars and seal points of contact between closure collar and insulation with vapor proof adhesive.
   4. Where ducts penetrate fire rated walls, provide fire proof sealant at closure collar. Refer to Division 07 Section "Through Penetration Firestop Systems", for fire proof sealant requirements.
   5. Secure closure collars to ducts with sheet metal screws at maximum 6-inch (152 mm) centers and secure closure collars to walls or floors with sheetrock screws, nails or other appropriate fastener at maximum 6-inch (152 mm) centers.

R. Packing: Pack with non-combustible glass fiber insulation in spaces between sleeve/opening and duct/duct insulation. Cover or seal edges of packing to contain loose fibers.

S. Duct Hangers and Supports: SMACNA HVACDCS, Section 4. Hang ducts up to and including 36 inches (914 mm) in width by a minimum of 1 in x 16 gauge (25 mm x 1.61 mm) flat straps on each side of the duct on 4 ft (1.22 m) centers, bent under bottom of duct a minimum of 2 inches (50 mm) and securely fastened to duct. Hang ducts larger than 36 inches (914 mm) in width by 3/8 inch (9.5 mm) steel rods and 2 x 2 x 1/4-inch (50x50x6.3 mm) steel angle trapeze hangers, spaced 4 ft (1.22 mm) on center. Provide seismic restraint complying with SMACNA SRMGMS. Anchor risers in the center of the vertical run to allow ends of riser free vertical movements. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.

1. Flexible Ducts: Support ducts by hangers every 3 feet (0.9 m), unless supported by ceiling construction. Use stretch flexible air ducts to smooth out corrugations, and long radius elbows, where possible, using a minimum length to make connections.
2. Flexible Connectors: Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connectors to metal collars.
3. Ducts with Extra Weight Such As Lead Lining or Lagging: Include the extra weight in determination of suitable hangers and supports.

END OF SECTION 233300

SECTION 233400 – HVAC FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Centrifugal Fans:
   1. Forward Curved Centrifugal Fans

B. Power Ventilators:
   1. Roof Exhausters.

C. Motors and Drives.

D. Fan Accessories.

1.2 RELATED SECTIONS

A. Division 23 Section “Common Motor Requirements for HVAC Equipment.”

B. Division 23 Section “Duct Insulation.”

C. Division 23 Section “Packaged, Outdoor, Central-Station, Air-Handling Units.”

D. Division 23 Section “Metal Ducts.”

E. Division 23 Section “Air Duct Accessories” - Backdraft dampers.

F. Division 23 Section “Instrumentation and Controls for HVAC.

G. Division 26 “Electrical.”

1.3 REFERENCES

A. Division 01 Section “Quality Requirements.”

B. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.

C. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings.

D. AMCA 99 - Standards Handbook.

E. AMCA 210 - Laboratory Methods of Testing Fans for Rating.

F. AMCA 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal.

G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

I. NEMA MG1 - Motors and Generators.

J. NFPA 70 - National Electrical Code.

K. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

L. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Vapors from Commercial cooking Equipment.

M. UL 705 - Power Ventilators.

1.4 SUBMITTALS

A. Division 01 Section "Submittal Procedures."

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate assembly of fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Division 01 Section "Closeout Procedures": Procedures for submittals.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section "Product Requirements": Transport, handle, store, and protect products.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.

B. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test-run under observation.

PART 2 - PRODUCTS

2.1 POWER VENTILATORS

A. Manufacturers:
   1. Cook
   2. Greenheck.
   3. Acme.

B. Product Requirements:
   1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
   2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
   3. Fabrication: Conform to AMCA 99.
   4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Roof Exhausters:
   1. Fan Unit: V-belt or direct driven as indicated, with spun aluminum upblast spun aluminum with grease tray housing; resilient mounted motor; 1/2 inch (13 mm) mesh, 0.62 inch (1.6 mm) thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
   2. Speed Control Switch: Wall mounted multiple speed switch. Unit mounted solid state speed controller.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Division 01 Section “Quality Requirements”: Manufacturer's instructions.

B. Install flexible connections between fan inlet and discharge ductwork; refer to Division 23 Section “Air Duct Accessories.” Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.

C. Secure roof exhausters with aluminum lag screws to roof curb.

D. Extend ducts through roof curb and into roof exhausters.

E. Provide sheaves required for final air balance.

F. Provide safety screen where inlet or outlet is exposed.

G. Where scheduled, provide backdraft dampers in ductwork on outlet from cabinet and ceiling exhauster fans and as indicated. Remove integral backdraft dampers.

H. Do not operate fans in normal operation until ductwork is clean, filters are in place, bearings are lubricated, and fan has been test run under observation.

END OF SECTION 233400

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers.
   1. Registers/Grilles.
   2. Drum Louvers.

1.2 RELATED SECTIONS

A. Division 09 Section “Interior Painting”: Painting of ductwork visible behind outlets and inlets.

1.3 REFERENCES

A. ADC 1062 - Certification, Rating and Test Manual.

B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.

C. AMCA 511 - Certified Ratings Program for Air Control Devices

D. ARI 650 - Air Outlets and Inlets.

E. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

F. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

G. NFPA 70 - National Electrical Code.

H. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets indicating type, size, application, rated airflow, noise level, pressure drop, and throw distance as applicable. Submit both manufacturer=s standard performance tables and graphs, AND tabulated selection data specific to this project. NOTE: Submittals without complete and sufficient information, to verify the performance specified and scheduled on the Drawings, shall be rejected.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Diffusers, Registers, Grilles, and Drum Louvers:
1. Price
2. Titus.
3. Krueger.
4. Anemostat.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, adjustable pattern, diffuser to discharge air in two way, three way or four way pattern (see drawings for air flow directional air flows).

B. Frame: Surface mount and lay in type. Drywall, provide plaster frame and ceiling frame.

C. Fabrication: Aluminum with baked enamel off-white finish.

2.3 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Frame: 1 inch margin with countersunk screw mounting. Channel lay-in frame for suspended grid ceilings.

B. Fabrication: Aluminum with factory baked enamel finish.

2.4 DRUM LOUVERS

A. Type: Rotating drum capable of rotating a minimum of 25 degrees up and down from center line of diffuser, with felt seal between drum and border frame to stop leakage and hold drum in position. Streamlined and individually adjustable extruded blades to spread the discharge air with one-way deflection.

B. Frame: Fully welded corners with steel reinforcement patches, 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions with factory off-white enamel aluminum paint mill finish.

D. Damper: Integral, gang-operated, opposed blade type with screwdriver operator, operable from face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09 Section “Interior Painting.”

F. Surfaces exposed to view shall be clean, and free of stains, smudges, and scratches.

END OF SECTION 233700

SECTION 237413 – PACKAGED, OUTDOOR, CENTRAL-STATION, AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged roof top unit.

B. Heat Exchanger.

C. Refrigeration Components.

D. Unit controls.

E. Roof mounting curb and base.

1.2 REFERENCES

A. ARI 210 - Unitary Air-Conditioning Equipment.

B. ARI 240 - Air Source Unitary Heat Pump Equipment.

C. ARI 270 - Sound Rating of Outdoor Unitary Equipment.

D. ARI 360 - Unitary Air-Conditioning Equipment.

E. ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.

F. ANSI/ASHRAE 90A - Energy Conservation in New Building Design

G. NFPA 70 - National Electrical Code.

H. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

1.3 SUBMITTALS

A. Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.5 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

B. Unit shall conform to UL 1995/CSA 22.2 #236 for construction of packaged air conditioner and shall have UL/CSA label affixed to rooftop package.
   1. In the event the unit is not UL/CSA approved, the manufacturer shall, at his expense, provide for a field inspection by a UL/CSA representative to verify conformance to UL/CSA standards. If necessary, contractor shall perform required modifications to the unit to comply with UL/CSA, as directed by the UL/CSA representative, at no additional expense to the Owner.

C. Gas-fired heating rooftop units shall conform to ANSI Z21.47/Canadian Standards Association (CAN/CSA-2.3) for construction of packaged air conditioner.
   1. In the event the unit is not CSA approved, the manufacturer must, at his expense, provide for a field inspection by a CSA representative to verify conformance to CSA standards. If necessary, contractor shall perform modifications to the unit to comply with CSA, as directed by the CSA representative, at no additional expense to the Owner.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.

B. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.7 WARRANTY

A. Provide a full parts warranty for one year from substantial completion.

B. Provide five year extended warranty for compressors including materials only.

C. Provide five year limited warranty for heat exchanger including materials only.

1.8 ACOUSTICS

A. Manufacturer of packaged rooftop equipment shall provide indoor and outdoor sound power level data across major octave band center frequencies for cataloged operating range of unit at gross cooling capacity range. Data shall be obtained in conformance with ANSI S1.32-1980, American National Standard Methods for the Determination of Sound Power Levels of Discrete Frequency and Narrow Band Noise Sources in Reverberation Rooms and per AMCA Standard 300-85 test code "Sound Rating Air Moving Devices".

1.9 EXTRA MATERIALS

A. Division 01 Section “Closeout Procedures.”

B. Provide one set of filters.

PART 2 - PRODUCTS

2.1 PACKAGED ROOFTOP UNIT

A. Approved Manufacturers:
   1. Trane
   2. McQuay

B. Air Conditioning Units:
   1. General: Roof mounted units having gas burner and electric refrigeration.
   2. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
   3. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Division 26.

C. Fabrication:
   1. Cabinet: Galvanized steel with baked enamel finish, access doors or removable access panels with quick fasteners, locking door handle type with piano hinges. Structural members shall be minimum 18 gauge (1.20 mm), with access doors or removable panels of minimum 20 gauge (0.90 mm).
   2. Insulation: One inch (25 mm) thick neoprene coated glass fiber with edges protected from erosion.
   3. Heat Exchangers: Aluminized steel, of welded construction.
   4. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted high efficiency motor or direct drive as indicated. Isolate complete fan assembly.
   5. Air Filters: 2 inch (50 mm) thick glass fiber disposable media in metal frames.
   6. Mounting:
      a. Roof Mounting Curb: Provide curb adapter for integration with existing roof curb.

D. Burner:
   1. Gas Burner: Atmospheric Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.
   2. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.
   3. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

4. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

E. Evaporator Coil:
1. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.
2. Provide capillary tubes or thermostatic expansion valves for units of 6 tons (21 kw) capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons (26 kw) cooling capacity and larger.

F. Compressor:
1. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.
2. Five minute timed off circuit to delay compressor start.
3. Outdoor thermostat to energize compressor above 35 EF ambient.
4. Provide step capacity control by cycling compressors.

G. Condenser Coil:
1. Provide copper tube aluminum fin coil assembly with sub-cooling rows and coil guard.
2. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

H. Mixed Air Casing:
1. Dampers: Provide manual outside air dampers for fixed outside air quantity.

2.2 OPERATING CONTROLS

A. Units shall be Trane Summit Control System with BACNET.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 Section “Project Management and Coordination”: Verification of existing conditions prior to beginning work.

B. Verify that roof is ready to receive work and opening dimensions are as indicated on Shop Drawings.

C. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Roof mounted: Mount units on factory built roof mounting curb adapters providing watertight

enclosure to protect ductwork and utility services or on existing grillage. Install roof mounting level.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Division 01 Section “Quality Requirements.”

B. Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.

C. Manufacturer shall furnish a factory trained service engineer without additional charge to start the unit (s) and to coordinate interface with building-s ATC system (coordinate with Division 23 Section “Instrumentation and Controls for HVAC”). Packaged rooftop unitary manufacturers shall maintain service capabilities no more than 100 miles from the jobsite.

END OF SECTION 237413

SECTION 260010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to all Division 26 Sections.

B. Intent Is to Provide and Install Complete Electrical Systems, as Required to Accommodate the renovation of the Existing Building.

C. Access Panels: Where required by NFPA 70 (N.E.C.)

D. All Cable Bundles Shall Be Limited to a Maximum of 12 Cables, Individual Bundles of Cables Shall Be Separated by at Least 2 Inches in All Directions.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. Examine all contract documents for requirements affecting the work.

1.3 DEFINITIONS

A. As used in this section, "provide" shall mean, "furnish and install". "Furnish" shall mean "to purchase and deliver to the project site complete with every necessary appurtenance and support", and "Install" shall mean "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

1.4 WORK BY OWNER

A. The Owner will be responsible for all work associated with the following:
   1. Electrical service and distribution equipment.

1.5 WORK BY TENANT

A. The Tenant will be responsible for all word associated with the following:
   1. Security System.
   2. Sound System.
   3. Access Control System.
   4. Main Computer System.

1.6 SUBSTITUTIONS

A. Refer to Division 01 Section “Substitutions and Product Options”.

1.7 ALLOWANCES

A. Cash Allowance: None.

1.8 ALTERNATES

A. None.

1.9 REFERENCES

A. NEMA Standards.

B. NECA "Standard of Installation."

C. NFPA 70 (N.E.C.) latest edition.

D. NFPA 101 Life Safety Code.

E. U.L. Standards.

F. ANSI Standards.

1.10 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include products specified in Division 26 individual sections.

C. Submit Shop Drawings and product data grouped by individual Sections to include complete submittals of related systems, products, and accessories. Label each with Section number and title. Partial Section submittals will not be reviewed.

1.11 RECORD DRAWINGS

A. Keep a marked set of Drawings at the site as a record set indicating all revisions in the work as the work progresses. At the completion of the work, mark the Drawings "As-Built Drawings" with the Contractor's name and date, and deliver to the Architect.

1.12 PERFORMANCE REQUIREMENTS

A. Conform to requirements of the latest edition of ANSI/NFPA 70 National Electrical Code (N.E.C.).

B. Conform to requirements of all local, State and Federal laws and regulations, plus local electric utility company's rules, and the Fire Underwriters' requirements.

C. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

D. Secure and pay for all permits and certificates as required by local, State and Federal laws.

E. Request inspections from authority having jurisdiction.

F. Run separate circuits for lighting and receptacle outlets as indicated.
   1. Circuits shall be balanced and loads and capacities shall be in accordance with requirements of local electric light company and National Board of Fire Underwriters.
   2. Do not share neutral on branch circuits.

G. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.

H. The Drawings indicate only diagrammatically the extent, layout and the general location and arrangement of equipment, conduit and wiring. Become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment will be properly located and readily accessible.
   1. Note that drawings do not show all junction boxes and fixture whips for lighting fixtures recessed in accessible ceilings. Although not specifically shown on the drawings, these fixtures shall be wired from junction boxes and 6'-0" unsupported whips. Provide number of junction boxes as required to allow for the 6'-0" whips. Wiring from fixture to fixture is not allowed. See Division 26 Section “Luminaires”.
   2. Lighting and Devices shown with same panel and circuit designation with no home run symbol may share same home runs to panelboards provided that the furthest device on the circuit does not exceed 2-1/2% voltage drop.
   3. Where home run symbols are shown, use separate run to panelboard for each symbol, and do not share home run with other devices having same panel and circuit designation.

1.13 PROJECT/SITE CONDITIONS

A. Coordinate with all other trades to ensure proper access and space requirements.

B. Where project conditions occur necessitating departures from the drawings, submit for approval the details of and reasons for departures prior to implementing any change.

C. Alterations
   1. Visit the site and become familiar with the existing conditions, and the requirements of the Plans and Specifications. No claim will be recognized for extra compensation due to failure of becoming familiar with the conditions and extent of the proposed work.
   2. Execute all alterations, additions, removals, relocations, or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the Drawings and Specifications.
   3. Repair or replace to the Owner's satisfaction, all existing work disturbed or damaged by the alterations.
   4. Retain ownership and remove from site all existing materials, equipment, fixtures, wiring and devices disconnected and not reused; Pay all charges for proper disposal of materials:
   5. Do not reuse existing wiring except as specifically indicated. Existing conduit raceways may be reused, provided that the existing wires are removed and new wires are installed.
   6. Provide finished blank plates on all existing ceiling and wall boxes which can not be removed.
   7. Ensure all circuits in existing buildings are re-energized where existing panelboards are replaced, or existing wiring is rerouted, disconnected, or disturbed. Provide and install new wiring as required to meet this condition. Verify breaker/fuse sizes on existing circuits and do not load wiring to beyond 75% of rated ampacity.

1.14 SEQUENCING AND SCHEDULING

A. Construct Work in sequence under provisions of Division 01.

B. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted services for the building or any of its sections. If necessary, install temporary work to provide for this condition. Authorization for interrupting services shall be obtained, in writing, from the Owner. Costs for overtime work and temporary work shall be included in the bid.

1.15 TEMPORARY LIGHT AND POWER

A. Make arrangements to provide temporary power. Coordinate with Owner to extent temporary services from the existing building. Temporary Power shall be maintained through to substantial completion of project. Include power used for temporary trailers, tools, charging tools and powered lifts, testing and start-up of equipment.

B. Furnish all temporary equipment, wiring, lamps, etc., as required for the completion of the work, including the work of all Subcontractors.

C. Temporary electrical work shall comply with OSHA and NEC requirements.

D. Lighting level in all areas for the duration of construction period shall be a minimum of 5 foot candles or per OSHA requirements, whichever is greater. Provide a minimum of 50 foot candles for taping and painting of all surfaces, and for surfaces receiving finishes, including flooring and tile. When permanent light fixtures are installed, these units may be used to provide required lighting level, but shall be relamped with correct lamps prior to building turnover to Owner."

PART 2 - PRODUCTS

2.1 PAINTING

A. Refer to Division 09 Section “Painting”.

2.2 ACCESS PANELS

A. Access panels required for items furnished under Division 26 shall be provided under this Division

B. Standard panels: 12" x 16" except as indicated. Doors: flush type 14-gauge steel, hinged to 16-gauge frame. Latch: Flush face screw operated. All factory primed and painted to match in the field.
   1. Same U.L. fire rating as wall, floor, or ceiling in which they are installed.
   2. Equal To: Inryco/Milcor style "M" and Miami-Carey "HM".

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION

A. Execute all work in a neat manner acceptable to the Local and State Electrical Inspector. Follow manufacturer's installation recommendations.

B. All electrical components and their attachments shall be properly supported and where required shall be designed for seismic forces.

C. Lighting fixtures shall be supported from structural steel. Provide unistrut channels or equal to span between top cord of joists. See Division 26 Section “Luminaires”.

D. Perform all electrical work by licensed electricians well skilled in the trade and supervised by a Master Electrician.

E. Replace or repair to new condition, defective equipment and equipment damaged during installation or testing.

3.2 TESTING AND ADJUSTING

A. The entire installation shall be free from short circuits and improper grounds. Test in the presence of the Architects or their representatives.

B. Test feeders with the feeders disconnected from the branch circuit panels.

C. Test each individual branch circuit at the panel. In testing for insulation resistance to ground, the power equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code and the manufacturer's recommendations. Correct failure in a manner satisfactory to the Architect and Engineers.

D. Completely test and adjust each system specified under Division 26 for proper operation.

3.3 SLEEVES, INSERTS AND OPENINGS

A. Sleeves:
   1. Furnish and install all sleeves required for the work.
   2. Sleeves through exterior building walls or through concrete construction shall be rigid galvanized steel.
   3. Sleeves shall be sized to provide a total of not less than 1/2-inch clearance around conduit.
   4. Sleeves for setting into walls shall be flush with finished construction. Sleeves for setting into floor shall be embedded in concrete slab and extend approximately 2 inches above finished floors.
   5. All sleeved openings within building shall be sealed airtight using fire barrier caulking with a UL classification for use as a fire penetration seal for walls and floors with up to a 3-hour fire rating expanded.
   6. Sleeves shall be provided in all locations where cables and conduits penetrate walls and floors.

END OF SECTION 260010

SECTION 260111 – CONDUIT

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Metal Conduit.

B. Flexible Metal Conduit.

C. Liquidtight Flexible Metal Conduit.

D. Electrical Metallic Tubing (EMT).

E. Non-Metallic Conduit.

F. Flexible Nonmetallic Conduit.

G. Fittings and Conduit Bodies.

H. Innerduct - Non-Metallic Corrugated Flexible Raceway

1.2 RELATED SECTIONS

A. Division 01 Section “Submittal Procedures.”

B. Division 26 Section “Basic Electrical Requirements”

C. Division 26 Section “Surface Raceways.”

D. Division 26 Section “Wire and Cable.”

E. Division 26 Section “Boxes.”

F. Division 26 Section “Grounding and Bonding.”

G. Division 26 Section “Electrical Identification.”

1.3 REFERENCES

A. NECA "Standard of Installation."

B. NEMA Standards.

C. NFPA 70 N.E.C. latest edition.

D. U.L. Standards.

1.4 DESIGN REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 (N.E.C.)

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. Conduit Size: ANSI/NFPA 70 (N.E.C.) for conductors indicated. Increase size as required to include bonding conductors specified.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include expansion fittings for all conduit types used on the project.

C. Include fire-stop seals and fillers.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Project Record Documents”.

B. Accurately record actual routing of conduits 2” and larger.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products delivered to the site.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to meet project conditions.

D. Where conduit routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in minimum size 3/4 inch conduit.

B. Underground Installations:
   1. More than Five Feet from Foundation Wall: Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thickwall nonmetallic conduit PVC-80, thinwall nonmetallic conduit PVC-40 encased in concrete where indicated.
   2. Within Five Feet from Foundation Wall: Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thickwall nonmetallic conduit PVC-80, thinwall nonmetallic conduit PVC-40.
   3. In or Under Slab on Grade:
      a. Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thickwall nonmetallic conduit PVC-80 and thinwall nonmetallic conduit PVC-40.
      b. Rise through slab in rigid galvanized steel conduit.
      c. Conduit larger than 3/4" shall run below slab.
   4. Minimum Size: 3/4 inch.
   5. Under paved areas: rigid galvanized steel conduit or concrete encased PVC-40.
   6. Metallic conduits buried in soil: Coated with Bitumastic #50.
   7. Primary electrical service conduits from riser pole to pad mounted transformer: concrete encased PVC-40.
   8. Communications (telephone, data, catv) service entrance conduits from riser pole to building: concrete encased PVC-40.

C. Outdoor Locations, Above Grade: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit.

D. In Slab Above Grade:
   1. Use rigid galvanized steel conduit, intermediate metal conduit, electrical metallic tubing with water tight connectors.
   2. Maximum Size Conduit in Slab: 3/4 inch.
   3. Rise through slab in rigid galvanized steel conduit.

E. Interior Wet and Damp Locations: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit.

F. Dry Locations:
   1. Concealed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
   2. Concealed/ Accessible: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
   3. Exposed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
      a. Exposed conduit: Not allowed in finished areas except as specifically noted.
      b. Finished areas: Exposed raceways specified under Section 260112: Surface Raceways.

G. Panel Feeders: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, and electrical metallic tubing.

H. Couplings and connectors for electrical metallic tubing up to 2" shall be steel set screw or compression type. Set-screw connection shall be used for all tubing sizes with a minimum of four set-screws for coupling and two set-screws for connectors and fittings for sizes 1-1/4" and larger.

I. Couplings and connectors for rigid and intermediate metal conduit shall be threaded.

J. Termination for all conduit and tubing shall have insulated bushings or insulated throat connectors in accordance with code requirements.

K. Permanent Connection to Motors: Dry locations, use flexible metal conduit. Damp or wet locations, use flexible liquid tight Type UA conduit with approved liquid tight fittings. Maximum length two feet (2').

L. Inside Plant Innerduct: Premises Non-Metallic Corrugated Flexible Raceway designed for use with and without a conduit. Duct shall contain pre-installed pull string.
   1. Carlon Plenum-Gard or equal for sizes 3/4" to 2"ID. Use where plenum cable is required and where indicated.
   2. Carlon Riser-Gard or equal for sizes 3/4" to 2"ID. Use where riser cable is required and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In general, all raceways shall be concealed above ceilings and within finished walls - securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be exposed overhead such that all raceways are parallel or perpendicular to joists, columns or beams and all drops to wall devices shall be concealed in walls. All wiring that is visible in exposed ceiling areas shall be in EMT or rigid conduit.

B. Install exposed only where specifically indicated.

C. Aluminum conduits shall not be installed below grade or in poured concrete or masonry.

D. Install conduit in accordance with NECA "Standard of Installation."

E. Install nonmetallic conduit in accordance with manufacturer's instructions.

F. Arrange supports to prevent misalignment during wiring installation.

G. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

H. Group Related Conduits:
   1. Support using conduit rack of Power-Strut, or approved equal.
   2. Parallel runs shall be neatly clustered with all bends and offsets of uniform pattern
   3. Provide space on each for 25 percent additional conduit.

I. Substantially support with approved clips or hangers spaced not to exceed ten feet (10') on centers except 1/2" rigid conduit and 1/2" and 3/4" electrical metallic tubing shall have supports spaced not to exceed six feet (6').

J. Fasten conduit supports to building structure.
   1. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   2. Do not attach conduit to ceiling support wires.
   3. Conduits larger than 2@ shall be supported from top cord of joists.

K. Arrange conduit to maintain headroom and present neat appearance.

L. Route conduit parallel and perpendicular to walls.

M. Route conduit in and under slab from point-to-point.
   1. Install only where specifically indicated or required.
   2. Obtain approval from the Architect before installation.

N. Do not cross conduits in slab.

O. Maintain adequate clearance between conduit and piping.

P. Maintain 6 inch clearance between conduit and surfaces with temperatures exceeding 104°F.

Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction. Use factory elbows or hydraulic one-shot bender to fabricate bends in metal conduit 2 inches or larger in size.

T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.

V. Provide suitable labeled nylon pull string in each empty conduit.

W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Use sleeves when passing through floors and walls.

Y. When serving roof top equipment, conduit shall enter within the weather-proof curbing. Maintain water tight roofing system.

Z. Ground and bond conduit under provisions of Division 26 Section “Grounding and Bonding”.

AA. Identify conduit under provisions of Division 26 Section “Electrical Identification”.

BB. All elbows in concealed nonmetallic conduit runs shall be rigid galvanized steel to eliminate "burn through" when pulling in conductors.

3.2 FIELD QUALITY CONTROL

A. No wire shall be installed until work which might cause damage to wires or conduits has been completed.

B. Conduits shall be thoroughly cleaned of water or other foreign matter before wire is installed.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire-resistance rating of partitions and other elements, using approved seals, fillers and materials.

END OF SECTION 260111

SECTION 260112 - SURFACE RACEWAYS

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Surface Metal Raceways.

B. Multi-outlet Assemblies.

C. Wireways.

D. Modular Tel-Power Poles.

1.2 RELATED WORK

A. Division 26 Section “Basic Electrical Requirements.”

B. Division 26 Section “Conduit.”

C. Division 26 Section “Wiring Devices.”

D. Division 26 Section “Grounding and Bonding.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. latest edition.

C. U.L. Standards.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.).

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

C. Size per N.E.C. and manufacturer's recommendations.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include product data for surface metal raceways, multi-outlet assemblies, wireways, and accessories.

PART 2 - PRODUCTS

2.1 SURFACE METAL RACEWAYS

A. Acceptable Manufacturers
   1. Wiremold Series: 500
   2. Or approved equal.

B. Description: U.L. approved assembly comprising a metal base and cover to form a raceway designed for surface mounting. Cover removable to allow installation of wires after the base channel is installed.

C. Finish: Paint to match surroundings.

D. Fittings, Boxes and Extension Rings, Couplings, Elbows, and Connectors: Furnish manufacturer's standard accessories for a complete installation.

2.2 MULTI-OUTLET ASSEMBLY

A. Acceptable Manufacturers:
   1. Wiremold - Plugmold Series: #2000 - prewired
   2. Or approved equal.

B. Description: U.L. approved assembly comprising surface metal raceway with receptacles.

C. Receptacles: Convenience receptacle mounted in cover 18 inches on center.
   1. Receptacles for Series 2000: Rated 15A, prewired single circuit 3-wire with insulated grounding conductor.

D. Finish: Paint to match surroundings.

E. Receptacle Color: Black.

F. Fittings, Boxes and Extension Rings, Couplings, Elbows and Connectors: Furnish manufacturer's standard accessories for a complete installation.

2.3 WIREWAYS

A. Acceptable Manufacturers: Westinghouse.
   1. General Electric.
   2. Square D.
   3. Siemen.
   4. Or approved equal.

B. Description: U.L. approved narrow sheet metal enclosure, rectangular in cross section, hinged or removable cover for housing and protecting electric wires and cable and in which conductors are laid in place after the wireway has been installed as a complete system.

C. General purpose except as indicated. Raintight where installed outside or in damp locations, with knockouts only as required.

D. Size: As required by NEC Article 376 for the number and size wires indicated. Minimum 6 x 6 inches.

E. Cover: Screws with built-in protection for conductors.

F. Fittings, Couplings, Elbows, Offsets, End Caps and Connectors: Furnish manufacturer's standard accessories for a complete installation. Fittings shall have removable front covers for installation of wires.

G. Code gauge, enameled steel with rust inhibiting primer coat. Gray enamel finish except as noted.

2.4 MODULAR TEL-POWER POLES

A. Wiremold #25DTP-4, or equal. Column height: As required for indicated room. See room finish schedule.

B. Each pole shall be complete with minimum of two spec-grade duplex receptacles, mounting hardware, entrance fittings, ceiling plate trim and one tel/data outlet. See Division 26 Section “Telephone/Data System”.

C. Provide additional special outlets as indicated and required.

D. Power Connections: Minimum of 10'-0" type MC cable from junction box to allow pole to be moved

E. Tel/Data Connection: Cable with sufficient slack to move pole 10'-0".

PART 3 - EXECUTION

3.1 INSTALLATION

A. Exposed wiring shall not be installed in finished areas except as specifically indicated. Where existing conditions require building wiring to be exposed, use surface metal raceways. Obtain approval from the Architect prior to installing surface wiring.

B. Install products in accordance with manufacturer's instructions.

C. Mount multi-outlet assembly up as indicated on Drawings. Where shown above counters, mount directly above backsplash except as noted. Provide blank sections within 12 inches of sinks. Within 6'-0" of sink, use GFCI type receptacles or protect with GFCI type branch breaker.

D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

E. Maintain grounding continuity between raceway components to provide a continuous grounding path. Ground and bond under provisions of Division 26 Section “Grounding and Bonding”.

F. Support wireways as approved with supports located at every splice and fitting and at intervals not to exceed five feet.

END OF SECTION 260112

SECTION 260123 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire and cable.

B. Underground feeder and branch circuit cable.

C. Metal clad cable.

D. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

B. Division 26 Section “Conduit.”

C. Division 26 Section “Surface Raceways.”

D. Division 26 Section “Boxes.”

E. Division 26 Section “Electrical Identification.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

1.4 DESIGN REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.

C. All conductor sizes shown are based on copper.

D. Manufacturer's name, wire size and insulation type shall be clearly marked on the insulation or jacket.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division

01 Section “Submittal Procedures”.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.

C. Include MC manufacturer’s specification sheets indicating construction, diameter, ampacity and bending radius.

1.6 PROJECT CONDITIONS

A. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

B. Where wire and cable routing is not shown, and destination or circuit number only is indicated, determine exact routing and lengths required.

1.7 COORDINATION

A. Locate such that outlets are readily accessible.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. American Insulated Wire Corp.

B. Southwire Company

C. Carol Cable.

D. Allied Wire & Cable.

E. Cerro Wire.

2.2 WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductors: all conductors shall be copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70 (N.E.C.), Type THHN/THWN, XHHW, rated 90 degrees C.

2.3 METAL CLAD CABLE

A. Description: ANSI/NFPA 70 (N.E.C.), Type MC with separate insulated ground.

B. Conductor: Copper, maximum # 10 AWG.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90EC.

E. Armor Material: Steel or Aluminum.

F. Armor Design: Interlocked Metal Armor.

G. Jacket: None.

2.4 WIRING CONNECTORS

A. Use the Following Types As Herein Specified:
1. Split bolt connectors.
2. Solderless pressure connectors.
3. Spring wire connectors.
4. Compression connectors.
5. Insulation piercing connectors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

A. Concealed Dry Interior Locations: Use only wire Type THHN/THWN, XHHW insulation, in raceway or metal clad cable.

B. Accessible Dry Interior Locations (such as above acoustical ceilings): Use only wire Type THHN/THWN, XHHW insulation, in raceway or metal clad cable.

C. Exposed Dry Interior Locations:
1. Use exposed wiring only where specifically indicated.
2. Use only building wire Type THHN/THWN, XHHW insulation, in raceway.

D. Wet or Damp Interior Locations: Use only building wire Type THHN/THWN, XHHW, insulation, in raceway.

E. Exterior Locations: Use only building wire Type THHN/THWN, XHHW insulation, in raceway.

F. Underground Installations: Use only building wire Type THHN/THWN, XHHW insulation, installed in raceway except as indicated on the Drawings.

G. Panel Feeders: Use only building wire Type THHN/THWN, XHHW insulation, in raceway.

H. Use other wiring methods only as specifically indicated on Drawings.

3.4 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in raceways.

C. In general, all wire in raceways and cable shall be concealed above ceilings and within finished walls, securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be raceways exposed overhead such that all raceways are parallel or perpendicular to joists, columns or beams and concealed in walls.

D. Use solid or stranded conductor for branch circuits #10 AWG and smaller. If stranded conductors for #10 AWG and smaller are used, provide vinyl insulated support crimp-on fork terminals for all screw head terminations. Barrel lugs and screw activated compression clamps on back wired devices shall not require crimp-on terminals.

E. Use stranded conductor for feeders and branch circuits #8 AWG and larger.

F. Use stranded conductors for control circuits.

G. Minimum Size Conductors for Power and Lighting Circuits #12 AWG Except as Follows:
1. Minimum #10 AWG for 120 volt circuits more than 100 feet long.
2. Minimum #10 AWG for 277 volt circuits more than 230 feet long.
3. Sizes shall be not less than indicated.
4. Note: Wire sizes indicated on drawings and schedules are minimum requirements and shall be adjusted to meet the above criteria.

H. Use conductor not smaller than #14 AWG for control circuits with fusing sized accordingly.

I. Pull all conductors into raceway at same time.

J. Use suitable wire pulling lubricant for building wire #4 AWG and larger.

K. Support cables above accessible ceiling, using spring metal clips or approved cable ties to support cables from structure. Do not support from ceiling suspension system. Do not rest cable on ceiling panels. Do not drape over ductwork or between bar joists. Wiring shall not be run diagonally and shall be cabled neatly.

L. Use approved cable fittings and connectors.

M. Neatly train and lace wiring inside boxes, equipment, and panelboards.

N. Clean conductor surfaces before installing lugs and connectors.

O. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

P. Use split bolt connectors, insulation piercing connectors or U.L. approved insulated connectors for copper conductor splices and taps, #6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

Q. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.

R. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

S. Wiring in sleeves passing through fire-rated barriers shall be sealed/filled with approved material to maintain the fire rating.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Division 26 Section “Electrical Identification”.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each branch circuit conductor.

D. Verify proper operation of each circuit.

END OF SECTION 260123

SECTION 260130 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall and Ceiling Outlet Boxes.

B. Pull and Junction Boxes.

C. Hinged Cover Cabinet Enclosures.

D. Terminal Blocks and Accessories.

E. Recessed Floor Device Boxes.

F. Flush Floor Device Boxes.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

B. Division 26 Section “Conduit.”

C. Division 26 Section “Wiring Devices.”

D. Division 26 Section “Grounding and Bonding.”

E. Division 26 Section “Equipment Wiring.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

1.4 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include product data for floor boxes, boxes larger than 12x12x6 inches and boxes with hinged covers.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Project Record Documents”.

B. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes 12x12x6 inches and larger, and boxes used for panel feeders.

1.6 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.

C. Size per N.E.C. Art. 314.

D. Covers for flush floor devices and poke-through fittings shall meet UL scrub water standards for installation in carpet and tile floors.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of wall boxes and outlets in offices and workout areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

D. Generally pull boxes are not shown on Drawings. Provide as required.

1.8 COORDINATION

A. Locate such that outlets are readily accessible and does not interference with other work.

B. Provide for access panel where required.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type, three and four inch deep or depth as to coordinate with concrete slab.
   3. Single Wall Type: Minimum size, four inch square by 2-1/8 inch deep, except as noted or as required by wall cavity depth. Provide dry wall plaster rings raised as required to insure flush finish mounting.
   4. Ganged Wall Type: Minimum depth 3 inches except as noted, ganged as required under common plate to contain device shown.

B. Cast Boxes: Type FS shallow or type FD deep, aluminum or cast feralloy.
   1. Provide number of threaded hubs as required.
   2. Use in all exterior, damp or exposed in mechanical space.
   3. Provide gasketed cover and accessories by box manufacturer for complete weatherproofing.

2.2 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
   1. Sizes up to 12x12x6 inch: Provide screw-type or hinged covers.
   2. Sizes greater than 12x12x6 inch: Provide hinged covers.

B. Exterior Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
   1. Material: Galvanized cast iron or Cast aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

2.3 CABINET ENCLOSURES

A. Covers: Continuous hinge, held closed by flush latch operable by key or screw driver. If keyed, match branch circuit panelboard; finish in gray baked enamel.

B. Boxes: Galvanized steel minimum 12"x12"x6" deep or as noted. Provide 3/4 inch (19 mm) thick plywood backboard painted matte white, for mounting terminal blocks.

C. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.

2.4 RECESSED FLOOR DEVICE BOXES

A. Walker (Wiremold) RFB series four-compartment combination reach-in type fully recessed and concealed floor box. Box shall be capable of providing service fittings for one duplex receptacle or one duplex voice/data outlet for each of four compartments (two data and two power), plus Flip-up lid. Include all components as required to provide the devices indicated. Provide blank plates where devices are not used to assure separation between line and low voltage. Minimum components shall include:
   1. RFB4-CI-1: Concrete-tight cat iron floor box, nominal 14 1/2"W x 11 7/8"W x 3 7/16"D with one 1" and one 1 1/4" feed thru per compartment. 2" pre-pour adjustability.
   2. Floor Port Activation Cover: TopGuard protection from water, dirt and debris. Hinged doors with seals, flanged Activation Kit with Die-Cast aluminum trim ring and access hatch. Apply carpet and or VCT to face of hatch to match surroundings.
   3. Box Accessories: Mounting plate for specific activity inserts and feed through wire management.
   4. Floor box Mudcap.
   5. Where floors require extra depth from concrete to finished floor, such as in the gymnasium, provide a fabricated a welded box extension ring to allow extra depth between box and access hatch. Extension ring shall have four mounting holes in bottom, one at each corner of

the box to secure the ring to the box, plus four threaded holes in the top, one at each corner of the ring to receive the access hatch. Fabricate the extension ring after installation and use field dimensions to assure proper fit. Laminate a 1/8" thick material in the hatch face to match surrounding material.

6. See room finish schedule for floor types.
7. UL listed for use on tile or carpet.
8. For on grade applications and in the gymnasium.
9. Equal by Hubbell.

B. Provide concrete mud slab below box for boxes installed at grade to assure proper leveling and to assure that box is imbedded in concrete on all sides.

2.5 FLUSH FLOOR DEVICE BOX

A. Manufacturers: Hubbell B423341 Series.

B. Description: Rectangular, cast iron, adjustable, floor box with separate compartments for power and data. Provide with minimum 1"threaded conduit hubs.

C. Flange: Two gang Brass UL524C Scrubshield. Coordinate with final finish floor material.

D. Size: Depth as required to install flush in concrete slab.

E. Cover: Single Brass similar to S2625 with 1" threaded plug. Duplex Brass similar to S3635 (Duplex Screw Plug), Duplex Brass similar to S3835 (Duplex Flap).

F. All floor outlets shall have one duplex power outlet interconnected with 3/4" conduit under slab to panel and one duplex data outlet or CATV outlet (as indicated on Drawings), interconnected with 1" conduit under slab to Tel/comm room. Include devices and Duplex covers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

1. Except where specifically noted, boxes on finished surfaces shall be flush mounted with finished cover plate.
2. Consult Architect prior to installing in finished areas.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. In accessible Ceiling Areas: Install outlet and junction boxes such that they are accessible from ceiling access panels or from removable recessed luminaires.

E. Install boxes to preserve fire-resistance rating of partitions and other elements, using materials and methods.

F. Align Wall Boxes for Switches, Receptacles, Thermostats, Telephone, and Similar Devices with Each Other as Follows:
   1. Horizontally for outlets with same mounting height.
   2. Vertically for outlets shown in similar locations with different mounting heights.

G. Do not install flush mounted boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic and fire rated walls.

H. Accurately position flush mounted wall boxes to allow for surface finish thickness.
   1. Box shall be flush with finished surface.
   2. Use wall box support brackets that span two studs.
   3. Single stud support will be allowed only if used with E-Z Mount Brackets or equal product to support side opposite the stud.

I. Install flush mounting box without damaging wall insulation and vapor barrier or reducing its effectiveness.

J. Use adjustable steel channel fasteners for hung ceiling outlet box.

K. Do not fasten boxes to ceiling support wires.

L. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

M. Use gang box where more than one device is mounted together. Do not use sectional box.

N. Use 4" square box with plaster ring for single device outlets.

O. Use cast outlet box in exterior locations exposed to the weather and wet locations.

P. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

Q. Set floor boxes level.

R. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
   1. Interior Dry Locations: Use hinged covers.
   2. Other Locations: Use surface-mounted cast metal box.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access doors with Division 08 Section.

B. Locate flush mounting box in masonry wall to require cutting of only one masonry unit. Coordinate masonry cutting to achieve neat opening.

C. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

D. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust floor box flush with finish flooring material.

END OF SECTION 260130

SECTION 260141 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall Switches.

B. Wall Dimmers.

C. Receptacles.

D. Device Plates.

E. Lighting Occupancy Sensors.

F. Relays and Contactors.

G. Timeclocks.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

B. Division 26 Section “Conduit.”

C. Division 26 Section “Wire and Cable.”

D. Division 26 Section “Boxes.”

E. Division 26 Section “Wiring Devices.”

F. Division 26 Section “Grounding and Bonding.”

G. Division 26 Section “Telephone/Data System.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

1.4 SUBMITTALS

A. Submit Shop Drawings for equipment and component devices in accordance with Division 01 Section “Submittal Procedures”.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and

configurations.

C. Include documentation showing compliance with UL, Fed. Spec. and NEMA references.

1.5 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Cooper; 5351 (single), 5352 (duplex).
2. Hubbell; HBL5361 (single), CR5352 (duplex).
3. Leviton; 5891 (single), 5352 (duplex).
4. Pass & Seymour; 5381 (single), 5352 (duplex)

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed -through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. Will not energize if line and load wiring are reversed.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Cooper; GF20.
2. Hubbell; GFR5252 (should be GFR5352)
3. Pass & Seymour; 2084

2.4 WALL SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
1. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).

2. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four

way).
3. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
4. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way)

C. Provide key switches, three-way, four-way switches, etc., as indicated matching the Series listed above. For keyed switches, provide minimum 2 keys per keyed device.

D. Device Body: Toggle handle type, color: Ivory.

E. Pilot Light: Neon type #1720-120v red. Separate gang position combined under same plate as switch or separately mounted.

2.5 LIGHTING OCCUPANCY SENSORS

A. Manufacturers:
1. The Watt Stopper: Model numbers listed except as noted.
2. Lightolier
3. Light-O-Matic
4. Sensor Switch

B. Complete with Faceplates, Color: White

C. Occupancy Sensor Room Ceilings: DT-300 dual technology ceiling mounted sensor
1. 24 VDC/VAC and halfwave rectified AC
2. Ultrasonic frequency of 40kHz
3. Time delays: SmartSet (automatic) and fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode. Set units for 15 minute delay to OFF.
4. Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity (for PIR sensitivity); ultrasonic sensitivity is variable with trimpot
5. Built-in light level sensor (DT-300) works from 10 to 300 footcandles
6. Low voltage, momentary switch input for manual operation
7. DT-300 contains an isolated relay with N/O and N/C outputs; rated for 1 Amp @ 30 VDC/VAC
8. Multi-level, 360° Fresnel lens for superior occupancy detection
9. Units per power pack: DT-300: up to 2 (B), up to 3 (BZ); DT-305: up to 3 (B), up to 4 (BZ)
10. Dimensions: 4.50" diameter x 1.02 deep (114.3mm x 25.91mm)
11. Typical PIR Coverage: 1000 sq.ft.
12. Typical Ultrasonic Coverage: 800-1200 sq.ft.
13. UL and CUL listed; Five year warranty
14. Provide power packs, mounting brackets and other hardware as required for a complete working system to cover the areas indicated.

D. Occupancy Sensor Wall Switch: DW-100 dual technology wall mounted sensor with manual-on override button with the following features:
1. Dual 120/277 VAC:
   a. @ 120VAC; 0-800W ballast or tungsten, 1/6 hp.
   b. @ 277VAC; 0-1200W ballast.
2. Time Delays; 5, 15 or 30 minutes, walk-through test-mode.

3. Coverage:
   a. Major motion; PIR 35’ x 30’, Ultrasonic 20’ x 20’.
   b. Minor motion; PIR 20’ x 15’, Ultrasonic 15’ x 15’.
4. Sensitivity adjustment: PIR – high/low, Ultrasonic – fully variable.
5. Compatible with all electronic ballasts.
6. Zero crossing control circuitry.
7. Manual-ON or Auto-On operation.
8. UL and cUL listed.
9. Five year warranty.
10. Color: Ivory.

E. Provide detailed wiring diagrams with submittals.

2.6 WALL DIMMERS

A. Manufacturers:
1. Lutron. Model NOVA-T Series except as indicated.
2. Lightolier
3. Or equal

B. Plastic with linear slide.

C. Voltage: 120 volts.

D. Power Rating: No less than 125% of load shown on Drawings. Minimum rating: 1000 watts.

E. Note that dimmers shall be compatible with loads indicated. Where dimmers are shown serving electronic solid state low voltage transformers such as for MR16 Lamps, then provide appropriate amplifier modules for proper operation. Locate as indicated or above accessible ceiling. Wire as required by the manufacturer-s installation instructions.

F. Device Body & Plate: Ivory.

2.7 RECEPTACLES

A. Receptacles shall represent manufacturer's highest quality receptacles other than hospital grade. Receptacles shall be back and side wired, provide green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and have all brass wrap around bridge for installation strength. Receptacles shall be UL 498 listed, Fed. Spec. WC596 and NEMA WD-6compliant. Duplex Convenience Receptacle, NEMA 5-20R, Rated 20 Amp:
1. Hubbell, Model HBL5362 or HBL5352.
2. P&S, Model 5362A
3. Leviton, Model 5362A.

B. GFCI Duplex Receptacle, Rated 20 Amp:
1. Same construction as specified above except with integral GFCI.

C. Telephone Jack: Specified under Section 260741.

D. Device Body: Nylon type, color: Ivory, except as noted.

E. GFCI Receptacle: U.L. Class A integral ground fault circuit interrupter.

2.8 WALL PLATES

A. Decorative Cover Plate: Ivory smooth face nylon.

B. Rain-Tight While-in-use Cover Plates: NEMA 3R Clear cover extra deep, Leviton 5966-DCL Series.

2.9 RELAYS/ CONTACTORS, AND TIME CLOCK CONTROLS

A. Similar to the following with characteristics as indicated or equal:

B. Control Relays: Allen-Bradley Bulletin "700" Series.
1. 120 volt coil as required.
2. Number of poles as indicated or required. Minimum number of poles: two.
3. Minimum continuous ampere rating: 5 amps.
4. Enclosure: NEMA-1, except as noted.
5. Electrically held, except as noted.
6. 600 volt rated.
7. For non-lighting low voltage control applications.

C. Lighting Relays/ Contactors: Allen-Bradley Bulletin "500L" Series.
1. 120 volt coil as required.
2. Number of poles as indicated or required. Minimum number of poles: two.
3. Minimum continuous ampere rating: 125 percent of the connected load, except minimum 20 amps.
4. 600 volt rated.
5. Enclosure: NEMA-1, except as noted.
6. Electrically held, except as noted.
7. Rated for lighting and heating loads.

D. Lighting Relays/ Contactors used to bypass switches: UL 924 approved LC&D GR 2001 E/S Emergency/Shunt Series.
1. 120 volt coil as required.
2. Single pole wired in parallel with wall switch.
3. Minimum continuous ampere rating: 20 amps up to 277 volts.
4. Rated for 40,000 operations @ 20A, 277 volts.
5. Enclosure: NEMA-1, standard 4"x 4" x 2 1/4" junction box.
6. Electrically held, except as noted.
7. ETL listed to UL STD 916 and UL 924.

E. Motor Load Relays/ Contactors: Allen-Bradley Bulletin "500" Series.
1. 120 volt and 277 volt coil as required.
2. Number of poles as indicated or required. Minimum number of poles: three.
3. Horsepower rated for connected motor, except minimum NEMA size 0.
4. 600 volt rated.
5. Enclosure: NEMA-1, except as noted.
6. Electrically held, except as noted.

F. Time Clock Control: Tork Model #DZS200-Series.
   1. Digital two channel astronomical with LCD display.
   2. 120volt, 240 volt and 277 volt as required to match voltage indicated.
   3. 48 events per channel/per week.
   4. 16 individual holiday dates.
   5. 72 hour memory backup with rechargeable battery.
   6. NEMA type III indoor/outdoor enclosure.
   7. Contact ratings: 10 amperes at 277 volt.

G. Photoelectric Control: Tork # model 2101 for 120 volts and model 2104 for 277 volts.
   1. Adjustable ON/OFF: ON range from 2 to 50 f/c.
   2. Rated 2000 watts tungsten at 120, 240 and 277 volts.
   3. Enclosure: Die-cast zinc, gasketed for exterior use.
   4. Cell: Cadmium sulfide, 1" diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices and plates vertical and plumb. Boxes shall be flush with finished surface.

C. Install switches with Off position down.
   1. Locate close to door frame on latch side of door, or beyond swing of door where appropriate.
   2. Where door frames have side lights, switch shall be either located below side light where a 3'-0" mounting height is possible, or beyond the side light. Coordinate with door frame schedule.
   3. Switches indicated in the same area at the same mounting heights shall be ganged together under a common plate.

D. Install wall dimmers to achieve full rating specified. Do not break off cooling fins. Mount in separate gangs as required.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on top.

G. Where devices such as duplex receptacles, telephone/data outlets, and TV outlets are shown adjacent to each other, then group all under a common face plate.

END OF SECTION 260141

SECTION 260170 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) Latest Edition.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: Conform to requirements of ANSI/NFPA 70. (N.E.C.), except that the Minimum System Resistance shall be 10 ohms.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Product Data: Provide data for grounding electrodes and connections.

C. Manufacturer's Instructions: Include instructions for protection, examination, preparation and installation of exothermic connectors.

1.6 GROUNDING ELECTRODE SYSTEM

A. Metal underground water pipe.

B. Metal structure of the building.

C. Concrete-encased electrode in building footings.

D. Rod electrode.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Project Record Documents”.

B. Accurately record actual locations of grounding electrodes.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Manufacturers:
   1. ITT Blackburn.
   2. Or equal.

B. Material: Copper or Copper-clad carbon steel.

C. Diameter: 5/8 inch.

D. Length: Sectional 10 feet.

E. Use only "Acorn" style ground clamps for connections to rods.

2.2 MECHANICAL CONNECTORS

A. Manufacturers:

B. Material: Bronze.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers:
   1. Cadweld.
   2. Thermoweld.
   3. Or equal.

2.4 WIRE

A. Material: Copper.

B. Foundation Electrodes: #4/0 AWG.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements, but not smaller than indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install additional rod electrodes as required to achieve specified resistance to ground.

C. Install ground wire from water entrance to main service disconnect. Provide additional ground wire from main service to building structural steel, as required by NEC. Enclose wire in PVC-40 where exposed.

D. Equipment Grounding Conductor: Provide separate, 600 volt insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

E. Provide and install bonding conductor to each item of electrical equipment.

F. Bonding conductors shall be continuous where possible. Where splices are required, provide T & B, or approved equal, compression connectors of approved pattern. Insulate connectors to equivalent thickness of conductors.

END OF SECTION 260170

SECTION 260180 - EQUIPMENT WIRING

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Electrical Connections to Equipment Specified under Other Sections Or Furnished by Owner, Including but Not Limited to: Exhaust fans, air handling units, air-conditioning units, workout equipment, etc…

B. All line voltage wiring including final branch circuit connections to disconnects, motor controllers, and motors. See Drawings for wiring and equipment locations.

C. Fused and non-fused disconnect switches for the equipment, except disconnect switches specifically provided with the equipment.

D. Except as specifically noted, motors, magnetic or manual starters and thermal overload protection will be furnished with the equipment for installation under Division 26 Section “Equipment Wiring”.
   1. Single pole switches, switch and pilots, and light/fan switches shall be provided and installed under Division 26 Section “Equipment Wiring”.. Coordinate with equipment schedules on H&V Drawings.

E. Temperature Control Wiring: Provided and installed under Division 23 Section.

F. Roof Top Equipment: Whether shown or not on the Drawings, provide a weather proof GFCI service receptacle at units per code requirements. For 120 volt, 15 and 20 amp equipment, connect to line side of safety switch. For larger equipment, provide home run to nearest 120 volt, 20A, 1pole spare breaker. Label and show on as-built drawings.

1.2 RELATED SECTIONS

A. Division 01 Section “Summary”: Owner-furnished equipment.

B. Division 23.

C. Division 26 Section “Basic Electrical Requirements.”

D. Division 26 Section “Conduit.”

E. Division 26 Section “Wire and Cable.”

F. Division 26 Section “Boxes.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) Latest Edition.

C. U.L. Standards.

D. ANSI Standards.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

C. Drawings do not show all required disconnect servicing switches. Furnish and locate as required by N.E.C.

D. Size fuses and thermal elements per N.E.C. and manufacturer's recommendations.

E. Connect motors for correct voltage, phase and rotation.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include disconnect devices, wiring connections and special outlets.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Westinghouse.

B. I-T-E Siemens.

C. General Electric.

D. Square D.

2.2 DISCONNECT SWITCHES

A. Enclosed, heavy-duty type, except as noted with visible blades, Horsepower rated 600-volt and 250-volt ratings as required by the particular circuit.

B. NEMA-1 enclosure, for dry locations; NEMA-3R raintight for exterior locations.

C. Fuses and ampere rating and number of poles as indicated on Drawings, or as required by the specific equipment.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment, but in no case less than the wire specified under Division 26 Section “Wire and Cable.”

B. Conduit Connections to Equipment: Dry locations, use flexible conduit. Damp or wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').

C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

E. Semiportable Machines: Use heavy-duty oil-resistant type SO cord with stranded copper conductors No. 12 AWG, minimum size and number of wires as required to include each phase conductor, white neutral conductor, and green grounding conductor. Furnish and install Kellems Series H cord grips and spring hangers for each cord connected machine with overhead supply.

F. Make wiring connections in wiring compartment of prewired equipment in accordance with manufacturer's instructions.

G. Install disconnect switches, controllers, control stations, temperature switches as indicated or required.

END OF SECTION 260180

SECTION 260195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Nameplates and Tape Labels.

B. Wire and Cable Markers.

C. Conductor Color Coding.

1.2 RELATED SECTIONS

A. Division 09 Section “Painting.”

B. Division 26 Section “Basic Electrical Requirements.”

1.3 REFERENCES

A. NFPA 70 (N.E.C.) Latest Edition.

1.4 REQUIREMENTS

A. Label all panelboards plus circuits on all spaces of switchboards and distribution panels, all safety switches, controls, relays, junction boxes, pull boxes, pilot lights, special switches and outlets.

B. Nameplates shall identify function of device, space controlled, voltage conditions, fuse size, panel serving switch, as indicated or required without abbreviations. Details shall be as approved.

C. Conform to requirements of ANSI/NFPA 70. (N.E.C.) Art. 210, Color code for branch circuits.

1.5 SUBMITTALS

A. Submit Shop Drawings, in accordance with Division 01 Section “Submittal Procedures”.

B. Only include if details of nameplates, wiring markers and conductor color code are not as specified below.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.

B. Tape Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

C. Junction Box Labels: Hand lettered with indelible black marker. Indicate voltage and circuit.

D. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

E. Fire Alarm Junction Boxes: Paint red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment fronts using screws, or rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

C. Use embossed tape only for identification of individual wall switches, receptacles, and control device stations.

3.2 WIRE IDENTIFICATION

A. Conductors throughout the building shall be color coded to identify voltage and phases.
   1. All metallic bonding conductors - Green.
   2. Phase Conductors of 120/208 Volt System: Black, red, blue. Neutral: white.

B. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation.

C. Where Conductors Are Not Available in the Colors Indicated, Due to Size, Prewired Cable, or Other Reason: Install identifying adhesive bands 3/4" wide of colors indicated above around each conductor within six inches (6") and twelve inches (12") of each end and at a maximum of five foot (5') intervals along wireways, at back of panelboards, and wherever conductors are accessible.

D. Power and Lighting Circuits in Panelboard Gutters, Pull Boxes, and at Load Connection: Provide wire markers on each conductor and Identify with branch circuit or feeder number.

E. System Control Wires at Control Panel and Load Connection:
   1. Provide wire markers on each conductor and identify with number as indicated on manufacturer's schematic and interconnection diagrams and equipment manufacturer's Shop Drawings.
   2. Fire Alarm System: Follow local Fire Department color code and labeling standards.

END OF SECTION 260195

SECTION 260510 – LUMINAIRES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior and exterior luminaires and accessories.

B. Exterior luminaires, poles, bollards and accessories.

C. Ballasts.

D. Lamps.

E. Additional wiring methods for luminaires.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

B. Division 26 Section “Conduit.”

C. Division 26 Section “Wire and Cable.”

D. Division 26 Section “Boxes.”

E. Division 26 Section “Grounding and Bonding.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

D. ANSI/NFPA 101 - Life Safety Code.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 (N.E.C.).

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Submit shop drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, performance data and total input watts.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site. Inspect for damage.

B. Protect from moisture, corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.7 SPARES

A. Provide replacement lamps for each lamp type installed as follows:
1. 10% where 1000 or more lamps of one type are installed.
2. 20% where less than 1000 lamps of one type are installed.
3. Minimum of 2 lamps for each type.

B. Provide replacement ballasts for each ballast type installed as follows:
1. 1% of total ballasts per type installed.
2. Minimum of 2 ballasts for each type installed.

1.8 PROJECT CONDITIONS

A. Wiring to fixtures as shown on Drawings is diagrammatic only and is intended to show circuit and switching arrangements. Fixtures shall not be used as raceways except as specifically allowed by N.E.C. Art 410.

B. Where panel designation and circuit numbers are shown with no homerun symbol, wiring to same circuits may share same homerun to panel.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Furnish products as specified in schedule on Drawings.

B. All fixtures shall be approved by Underwriters' Laboratories, Inc., and bear Underwriters' labels.

C. In addition to the manufacturers listed on the Drawings, fixtures with equivalent details and matching characteristics as provided by manufacturers listed below shall be considered for approval after review of Shop Drawings.

D. Manufacturers:

Halo	Exceline	Insight Lighting	Moldcast
Columbia	Holophane	Keystone	Peerless
Exceline	Hubble	KIM	QL
Cooper	ICE (ICON)	Lightolier	Spaulding
Daybrite	Keene	Litecontrol	SPI
Delta	Benjamin	Lithonia	Winona

E. Ballast: Provide ballast suitable for lamp specified.

F. Lamps: All lamps shall be furnished and installed in each fixture.

2.2 BALLASTS: Rated 120/277 volts or as noted.

A. Ballast Manufacturers:
1. Advance - Philips.
2. Osram – Sylvania.
3. Universal Lighting Technologies.
4. GE Lighting.

B. Fluorescent Ballast:
1. Fully electronic 25,000 Hz instant start, two, three and four lamp type. Quantities to allow switching as indicated on plans. Provide only rapid start lamps which are specifically designed to operate properly on instant start electronic ballasts.
2. Ballasts for all recessed fixtures shall be of the very low heat (VLH) design.
3. Total harmonic distortion shall be less than 15%.
4. Where fixtures run end to end, or are within the standard 11 foot ballast whip distance, then efforts shall be made to utilize as many four lamp ballasts as possible (driving four lamps). In all cases, ballasts shall be installed to drive the exact number of lamps they are designed for, Example - one lamp ballast drives one lamp, two lamp ballast drives two lamps, etc. Installation where this criteria is not followed will not be accepted.
5. Where fixtures can use 11 foot whips (master and satellite pairs), ballast shall be installed to drive the exact number of lamps indicated and fixture shall be provided with pre-manufactured ballast whips.

C. High Intensity Discharge (HID) Ballast:
1. High Intensity Discharge Fixtures: All rated for multiple volt operation, connected as indicated in the schedule.
   a. Metal Halide Fixtures: CWA or Peak lead auto transformer type with high power factor rating of 90% or better.
   b. High Pressure Sodium Fixtures: Constant wattage auto-transformer, high power factor.

2.3 LAMPS

A. Lamp Manufacturers:
1. Sylvania/Osram.
2. Philips.

3. Venture Lighting International.
4. General Electric.

B. Fluorescent Lamps: T8 (2900 lumen) T8 - High Lumen (3100 lumen) & T5HO (5000 lumen) as scheduled, designed to operate properly when driven by instant start electronic ballasts.

C. All Lamps shall be low mercury and non-hazardous, and shall pass the EPAs Toxicity Characteristic Leaching Procedure (TCLP) for the purpose of disposal.

D. Incandescent Lamps: Rated 130 volt.

E. High Intensity Discharge Lamps: Supplied as indicated.

F. Provide lamp types specified for luminaire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Complete with 660 watt sockets, wiring, ballasts, stems, hangers, fittings, end plates, pendant feeds, aircraft cable, etc.

B. Install in accordance with manufacturer's instructions.

C. Suspended Luminaires.
1. Pendants:
   a. 1/2" rigid conduit stems, painted to match fixture, with swivel mounts.
   b. Where indicated provide aircraft cable suspension. Feed end shall have canopy with feed grommet and white coiled cord wrapped around cable. Stretch coil making 1" gaps.
   c. Provide pendant length required to suspend luminaire at indicated height. Cut or lengthened to give mounting heights as indicated and required.
   d. Where fixtures are specifically indicated to be chain mounted, provide wire hook chain set & jack chains cut to length as required to suspend luminaire at indicated height. Use MC cable supported by cable ties from fixture to junction box mounted in structure above each fixture.
   e. Except as specifically noted, fixtures shall be supported from structural steel. Provide unistrut channels or equal to span between top cord of joists. Supports shall be suitable for fixture weight and seismic forces.
   f. Pendant suspension details shall be submitted for approval prior to installation.

D. Provide 12 gauge safety hanger wire supports for all fixtures recessed in ceiling grids of suspended acoustical ceilings. Hangers shall be independent of ceiling framing suspension system and shall extend from fixture housing to structure above. Lighting fixtures weighing less than 56 pounds shall have two hangers, at diagonal corners of fixture (2 locations). Lighting fixtures weighing more than 56 pounds shall have four hangers, one at each corner of fixture (4 locations). Wires shall have no tension (slack) to prevent ceiling distortion. In addition, attach to ceiling framing AT@s as required by code.

E. Fixtures with one (1) piece 8' channel shall be supported within two feet (2') of each end and fixtures with 4' channel shall be supported within one foot (1') of each end. Fixtures indicated in continuous rows shall have ends bolted together and shall be provided with 4' long lens constructed so the joint between two (2) sections of an 8' fixture appear the same as two (2) 4' fixtures butted together.

F. Fixtures in sloping ceilings shall have angle face plate for proper orientation of fixture.

G. Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Fixtures shall have frame and trim details to match the ceiling suspension system furnished. Coordinate details with Acoustical Treatment Section and installation with the Ceiling Installer to assure fixtures are centered on tiles or on joints as required.

H. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Install spacers where required to allow proper installation of rabbeted (Tegular) ceiling tiles. Secure to prohibit movement.

I. Install clips to secure recessed luminaires in place. Install recessed luminaires to permit removal from below.

J. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

K. Install wall mounted luminaires at height as indicated.

L. Install accessories furnished with each luminaire.

M. Additional Wiring Methods For Luminaires:
   1. Refer to Division 26 Section “Basic Electrical Requirements”: Performance Requirements.
   2. Refer to Division 26 Section “Wire and Cable”: Wiring Methods.
   3. Recessed and surface incandescent fixtures: Wiring rated minimum 300E F in metallic conduit where required for Underwriters' approval.
   4. Fluorescent Fixtures: Wiring within housings and between fixtures and junction boxes above ceilings shall be Type THHN insulated conductors rated for use at temperatures not lower than 90E C.
   5. Wiring From Recessed Fixtures To Junction Boxes: As described in Division 26 Section “Basic Electrical Requirements”: Performance Requirements.

N. Bond products and metal accessories to branch circuit equipment grounding conductor.

O. Install specified lamps in each luminaire.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Locate fixtures to avoid interference with mechanical and structural features.

3.3 FIELD QUALITY CONTROL

A. All fixtures and equipment shall be in first-class condition at time of delivery of building to Owners with all scratches, mars, etc., refinished to factory standards.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING/CLEANING/RELAMPING

A. Aim and adjust luminaires after dark as directed.

B. Relamp luminaires whose lamps have failed at Substantial Completion and six (6) months thereafter.

C. Clean electrical parts to remove conductive and deleterious materials.

D. Remove dirt and debris from enclosure.

E. Clean photometric control surfaces using procedures as recommended by manufacturer.

F. Clean finishes and touch up damage.

3.5 SCHEDULE

A. Shown on Drawings.

END OF SECTION 260510

SECTION 260535 – EMERGENCY LIGHTING EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Emergency lighting battery units.

B. Exit signs.

1.2 RELATED WORK

A. Division 26 Section “Basic Electrical Requirements.”

B. Division 26 Section “Conduit.”

C. Division 26 Section “Wire and Cable.”

D. Division 26 Section “Boxes.”

E. Division 26 Section “Grounding and Bonding.”

F. Division 26 Section “Luminaires.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) Latest Edition.

C. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.

D. U.L. Standards.

E. ANSI Standards.

1.4 DESIGN REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.(N.E.C.)

B. Conform to local and state building codes and NFPA 101 for installation requirements.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

D. All components of the same manufacturer.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division

01 Section “Submittal Procedures”.

B. Include all components, electrical characteristics, recommended maintenance procedures and intervals.

C. Submit manufacturer's instructions.

1.6 WARRANTY

A. Fully guaranteed for a minimum of three (3) years. Except as noted, batteries shall be warranted for an additional seven (7) years minimum, on a prorated basis with a life expectancy of ten (10) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lightalarms.

B. Sure-Lites.

C. Chloride.

D. Dual-Lite.

E. Or equal.

2.2 EMERGENCY LIGHTING BATTERY UNITS

A. Fully automatic, 90 minute operation, compact low-profile design. Injection molded, flame-rated, thermoplastic housing with universal mounting plate. Self-contained lamp and battery package.
   1. 120/277 VAC operation.
   2. Maintenance-free lead acid battery, 10 year warranty (5 years full, 5 years pro-rata).
   3. Two 7.2-watt, 6-volt incandescent sealed-beam lamps.
   4. Fully-automatic solid state electronics.
   5. Integral test switch.
   6. Built-in protection: AC lockout, transformer isolation, low battery voltage disconnect, brownout protection and 15 minute retransfer delay.
   7. LED indicators for “Service Alert” and “Operating Status” and visual faults indicators for battery, charger, transfer and lamp faults.
   8. Manual Tests: Test switch allows a programmable 1, 5, 30 or 60 minute system check at any time.
   9. UL924 Listed (emergency Lighting)
   10. Dual-Lite: EZ-2 Series.

B. Batteries: Sufficient capacity to supply and maintain at not less than 87-1/2 percent of system voltage the total lamp load indicated for a period of time as required by latest edition of NEC,(90 minutes minimum). Initially oversize to meet this criteria over battery's entire life.

2.3 EXIT SIGNS

A. Universal LED type self-powered, complete with ceiling, side wall brackets and arrows and faces as indicated. Brown out, low voltage disconnect, test switch, power indicator.

B. Precision-molded thermoplastic construction white face and red letters.

C. Red LED’s smooth look and no visible LED dots. Less than 3Watts input power.

D. Nickel Cadmium Battery with 15 year pro rated warranty.

E. Dual-Lite LX Series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units plumb and level.

B. Aim directional lamp heads to maximize light in egress paths and as directed.

C. AC Wiring to Exit Lights: In separate conduit, or MC cable with ground.

D. Exit Sign Mounting: Generally mount directly above and centered over the doorway opening, on the wall where possible, or mounted from the ceiling when wall mounting is not possible. End wall mounted where required, up 7'-6" AFF. The intent is to locate signs to allow for maximum visibility. Consult Architect before installation, if in question.

END OF SECTION 260535

SECTION 260721 – FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Complete Addressable Fire Alarm System including but not limited to:
   1. Equipment, materials, labor, installation, connection, programming, testing, training and performance of all operations of the intelligent reporting fire alarm system as indicated on the drawings and as herein specified.
   2. Alarm initiating devices, alarm notification appliances, fire alarm control panel (FACP), auxiliary control devices, remote annunciator, radio master box, and wiring.
   3. AES – 7788F master box to report Fire alarm events to the fire department.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

1.3 REFERENCES

A. NFPA 70 (N.E.C.) latest edition.

B. U.L. Standards.

C. FM Factory Mutual

D. NFPA 72 National Fire Alarm Code.

E. ADA - Americans with Disabilities Act.

F. NFPA 101 - Life Safety Code.

G. Local and State Codes.

H. Portland Fire Department - Rules & Regulations for the Installation of Fire Alarm Systems.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of NFPA 70. (N.E.C.), specifically Art 760.

B. Conform to requirements of the National Fire Protection Association, Standards NFPA 72 NFPA 101 and also all applicable Federal, State and local codes.

C. All requirements of the Authority Having Jurisdiction (AHJ).

D. All components of the same manufacturer, FM approved and listed by Underwriters' Laboratories, Inc., and so labeled.

E. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown. The fire alarm control panel, network interface and all transponders

shall meet the modular labeling requirements of U.L. Each subassembly, including all printed circuits, shall include U.L. modular labels.

F. Include all necessary software, programming and the selection of the proper type and quantities of the system components to assure a complete, operational, and Code Compliant System.

G. System shall be completely field programmable.
   1. Provide the Owner with all required components, interfaces and passwords to allow them full access to the programming features. Provide minimum of 8 hours on site training on programming features.
   2. Provide all hardware, software, programming tools, and documentation necessary to allow modifying the fire alarm network on site. Modifications include addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices and zones.
   3. The system structure and software shall place no limit on the type and extent of ON-SITE software modifications. Software modification shall not require power shut down of system and shall not cause loss of system fire protection while making modifications.

H. Special Programmable Features:
   1. This system (Plaza System) shall interface with the existing GE Quick Start (QS-1) addressable fire alarm system in the Mercy space to notify that system of an alarm condition elsewhere in the plaza. Upon notification, the Mercy system shall activate horns and lights within the space only it shall not report an alarm condition. Once the condition is cleared on the Plaza System, the condition shall automatically clear on the Mercy system. Interface shall also be made such that an alarm condition in the Mercy space will report to the Plaza System.

I. The drawings do not show all details of the Fire Alarm System. It shall be the responsibility of the authorized supplier/installer to provide a fully operational code compliant system.

J. Coordinate with and obtain approval from the local Fire Chief (AHJ), prior to the Shop Drawing submittal. See Item Submittals.

1.5 SYSTEM DESCRIPTION

A. Fire Alarm System: Addressable automatic and manual initiating, Intelligent reporting, microprocessor controlled fire detection and audible and emergency voice fire alarm system with network communications capabilities.

B. An active/interactive type system where each fire alarm device is repetitively scanned, causing a signal to be transmitted to the local fire alarm control panel indicating that the FACP and its associated initiating devices and notification appliance circuit wiring is functional. Loss of this signal shall result in a trouble indication on both the FACP display and at the remote annunciator.

C. System Performance and Supervision:
   1. Alarm, trouble and supervisory signals from all intelligent reporting devices: Encoded on NFPA style 4 (Class B) signaling line circuits (SLC).
   2. Initiating device circuits (IDC): Wired class A NFPA Style D as part of an addressable device connected by the SCL circuit (end of line returns to the panel using a separate path).
   3. Notification appliance circuits (NAC): Wired class B NFPA Style Y.

4. Digital electronic signals: Employ check digits or multiple polling.
5. Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode.
6. Occurrence of single ground or open condition in the initiating circuit does not disable any device on that circuit.
7. Occurrence of single ground or open condition on alarm initiating or signaling circuits does not disable that circuit from transmitting in ALARM.
8. Component or power supply failure places system in TROUBLE mode.
9. Alarm signals arriving at the main FACP shall not be lost following a primary power failure until the alarm signal is processed and recorded.
10. Batteries: Under or over battery voltage, shorted or disconnected battery supply places system in TROUBLE mode.
11. FACP devices are to consist of low current, solid-state integrated circuits, and shall be powered locally from a primary power and standby power source.
12. Power for initiating devices and notification appliances must be from the main fire alarm control panel, the FACP to which they are connected or to a Field Charging Power Supply (FCPS).
13. Notification appliance circuits shall have 25% spare capacity.

D. Alarm Sequence of Operation: Actuation of manual fire alarm station, automatic initiating device and sprinkler flow switches causes system to enter ALARM, which includes the following operations:
1. Indicate location of alarm zone on fire alarm control panels for all events.
2. Indicate on FACP and remote 80 character LCD display.
3. Transmit signals to the fire department.
4. Activate all programmed events.
5. Sound and display throughout the building the fire alarm (horn/light) signaling devices as required to evacuate all areas of the building.
6. See Special Programmable Features for additional requirements.
7. Duct mounted smoke detectors shall report as a supervisory condition.

E. Alarm Silence: The alarm horns may be silenced, after three (3) minutes, at the associated locked control cabinet. Alarm lights shall remain flashing until system is reset. A subsequent zone alarm shall reactivate the signals.

F. Alarm Reset: RESET function resets alarm system to NORMAL condition (out of ALARM) if alarm initiating circuits have cleared.

G. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:
1. Visual and audible trouble alarm by zone at associated control panel.
2. Visual and audible trouble alarm at annunciator panels.
3. Manual ACKNOWLEDGE function (trouble silence switch) at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.

H. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel resets the activated detector and waits for a second activation. If, after reset, a second alarm is reported from the same or any other smoke detector within one (1) minute the system shall process the alarm. If no second alarm occurs within one minute the system shall resume normal

operations. The Alarm Verification shall operate only for smoke detectors. Other activated initiating devices shall be processed immediately.

I. Zoning: Programmable, provide labor to reschedule zones as direct by owner and Fire Department.

1.6 QUALIFICATIONS

A. Fire alarm equipment Manufacturer:
   1. Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
   2. Company maintaining engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

B. Supplier/Installer (Vendor):
   1. Company authorized by the manufacturer and specializing in fire alarm systems with minimum five years experience.
   2. Company shall employ NICET (minimum Level II fire alarm technology) technicians.
   3. Company offering service contracts for continuing factory authorized service after the initial warranty period.

1.7 SUBMITTALS

A. Prior to submitting Shop Drawings to the Architect, set up a meeting at the Local Fire Department with a complete submittal package. Meeting shall include the Fire Chief, Assistant Fire Chief, and, System Vendor. Vendor shall present the proposed system to the Fire Department and describe in detail, the operation. Once the fire department is satisfied that the proposed system satisfies their requirement (including locations of ADA required Strobes), then the shop drawings may be submitted to the Architect along with a copy of the minutes of the meeting. Shop drawings will not be reviewed by the Architect without this presentation and minutes of the meeting.

B. Include floor plans showing all devices, wiring, and connections: Plan layout, connection diagrams and catalog cuts of all components. Use 1" = 20' composite contract drawing for shop drawing purposes and shall be marked-up showing all wiring between devices, number of conductors, and labeling system. Shop drawings will not be reviewed by the Architect without these drawings.

C. Include proposed wiring color code and verification that it meets local fire department standards.

D. Include narrative description of system functions and sequence of operation.

E. Include catalog cuts of all equipment, devices, annunciator layout, control panel modules, and internal terminal configurations.

F. Include documentation showing proof of U.L. listing for all system components.

G. Include System Power Supply Requirements:
   1. Total panel supervisory current.
   2. Total horn/light signal current.
   3. Total auxiliary power.
   4. Total smoke detector supervisory and alarm power.
   5. Total battery amp-hour calculations.

6. Total power on each Field Charger/Power Supply (FCPS).
7. Voltage drop on each notification circuit (voltage drop at each appliance).

H. Include all cable types.

I. Include letter verifying that system has been reviewed and approved by the local Fire Department.

J. Include second year extended service contract listing services included and costs. The cost of this service contract is included under this section.

K. Submit manufacturer's instructions.

1.8 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes 12x12x6 inches and larger.

B. Accurately record actual routing of conduits larger than 1 inch and main wiring trunks.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

C. Include operating instructions, and maintenance and repair procedures.

D. Include manufacturer's representative's letter stating that system has been tested and is operational. Use NFPA 72 FIRE ALARM SYSTEM CERTIFICATION and DESCRIPTION form.

1.10 EXTRA MATERIALS

A. Provide two manual pull stations.

B. Provide two keys of each type.

C. Provide one smoke detector of each type.

D. Provide one heat detector of each type.

E. Provide one Horn/Light and one adjustable Cd Strobe.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Notifier: Addressable system. Model numbers used except as noted.

1. Gamewell.
2. Simplex.
3. Edwards
4. Siemens

B. MASTER BOX – AES #7788F with GRI TSW-01S tamper switch - no substitutions.

2.2 FIRE ALARM CONTROL PANELS AND COMMAND CENTER

A. Fire alarm control panel shall be Notifier Model NFS2-640. Provide all necessary modules for a complete operational system as specified herein. Panel shall include a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, transponders, local and remote operator terminals, printers, annunciators, and other system controlled devices. All panel locks shall accept Gamewell, Simplex or FCI key.

B. FACP shall perform the following functions:
1. Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all signaling and notification circuits throughout the facility.
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
4. Visually and audibly annunciate any trouble, supervisory or alarm, condition on operator-s terminal, panel display, and annunciators.

C. Capacity and General Operation:
1. Each loop capable of expansion to 318 intelligent addressable devices. System capable of 2 loops. Provide number of loops as required to support the system indicated with a minimum of one loop. Provide expansion to be able to add an additional loop.
2. FACP shall include a full featured operator interface control and annunciation panel which shall include a backlit Liquid Crystal Display (LCD), individual, color coded system status LED-s and an alpha-numeric keypad for field programming and control of the fire alarm system.
3. FACP shall provide the following features:

Block Acknowledge	Printer Interface
Charger rate control	CRT Display Interference
Control-by-time	Non-Alarm Module Reporting
Day/Night Sensitivity	Periodic Detector Test
Device Blink Control	Remote Page
Drift Compensation	Trouble Reminder
NFPA 72, Sensitivity Test	Upload/Download to PC Computer
System Status Reports	Verification Counters
Security Monitor Points	Walk Test
Alarm Verification	Maintenance Alert

D. Central Processing Unit (CPU):
1. FACP shall include a central processing unit. The CPU shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.
2. Each CPU shall contain and execute all control-by-event interlock for specific local and

network action to be taken if an alarm condition is detected by the system. Control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

3. The central processing unit shall also provide a real-time clock for time annotation of all system displays. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

E. Signaling Line Circuits (SLC):

1. The system shall include four SLC circuit. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a system capacity of 318 devices. Each SLC loop shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring. The system shall have the space and capacity to add an additional two SLC circuits.
2. The Loop Interface Board (LIB) shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet NFPA 72, requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.
2. The system shall include an EIA-485 port for the serial connection of annunciators and remote LCD displays.
3. The EIA-485 interface may be used for network connection to a proprietary receiving unit.

G. Notification Appliance Circuit (NAC) Module:

1. The notification appliance circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.
2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.
3. The module shall not affect other module circuits in any way during a short circuit condition.
4. The module shall provide eight green ON/OFF LEDs and eight yellow TROUBLE LEDs.
5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.
6. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or wordprocessor.
7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.
8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.

H. Control Relay Module:

1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.
2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
3. The expansion module shall provide 8 green ON/OFF LEDs and 8 yellow LEDs (indicates disabled status of the relay).
4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.
5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or wordprocessor.
6. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

I. Remote Relay Module: Notifier model number ACM-8R
   1. Remote relay module with eight Form-C relays per module.

J. Operators Terminal: Provide the following functions in addition to any other functions required for the system:
   1. Acknowledge (ACK/STEP) Switch:
      a. Activation of the control panel Acknowledge switch in response to a single new alarm and/or trouble conditions shall silence the local panel piezo electric signal and change the system alarm or trouble conditions that exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
         1) Depressing the acknowledge switch shall also silence all remote annunciator piezo sounders.
   2. Signal Silence Switch: Activation of the signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm activation. The selection of notification circuits and relays which are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.
   3. System Reset Switch:
      a. Activation of the system reset switch shall cause all local electronically-latched initiating devices, software zones, output devices and circuits, to return to their normal condition.
      b. If an alarm condition(s) still exists, or if they occur in the system after system reset switch activation, the system shall then resound the alarm conditions.
   4. System Test Switch: Activation of the system test switch shall initiate an automatic test of all intelligent/addressable detectors in the local system. The system test shall activate the electronics in each transmission of the alarm condition from that sensor to the fire alarm control panel. The fire alarm control panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the system LCD and on any CRT-s or printers in the system.
   5. Alarm Activate (Drill) Switch:
      a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset. Drill switch shall release all door hold open device.
      b. The drill switch shall not Initiate the following: Signal to central receiving station(fire station) Fan shut down, smoke evacuation, and roof hatches,

6. Lamp Test Switch: Activation of the lamp test switch shall sequentially turn on all LED indicators, system liquid crystal display and local piezo signal, and then automatically return the fire alarm control panel to the previous condition.

K. Field Programming:
1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All local FACP node programming shall be accomplished through the FACP keyboard or through the video display terminal.
3. All field defined programs shall be stored in non-volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual ON/OFF commands. A second (higher-level) is used for actual change of program information. Passwords shall be made available to authorized personnel upon system acceptance.

L. Specific System Operations:
1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any and all analog intelligent detectors in the FACP node from each system keypad or from the keyboard of the video terminal. Sensitivity range shall be within allowed UL limits.
2. Alarm Verification: Each of the intelligent addressable detectors in the system may be independently selected and enabled for alarm verification. Each FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. System Point Operations:
   a. All devices in the FACP node may be enabled or disabled through the local keypad or video terminal.
   b. Any FACP node output point may be turned on or off from the local system keypad or the video terminal.
4. Point Read: The FACP node shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
   a. Device Status
   b. Device Type
   c. Custom Device Label
   d. Software Zone Label
   e. Device Zone Assignments
   f. Detector Analog Value
   g. All Program Parameters

5. System Status Reports: Upon command from a password-authorized operator of the system, a status report will be generated, and printed, listing all local FACP system status.
6. System History Recording and Reporting: Each FACP node shall contain a history buffer that shall be capable of storing a minimum of 400 system events. Each local activation will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and/or printed. The history buffer shall use non-volatile memory.

7. Automatic Detector Maintenance Alert: Each FACP node shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular intelligent detector will be annunciated on the system display, network display and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

2.3 SYSTEM COMPONENTS - CONVENTIONAL

A. Horn/Strobes: Combination Audible/Visible signals shall be similar to Wheelock #MT series.
1. Peak sound output: 90 dBA.
2. Ability to silence the horn while leaving the visible signal active.
3. Capable of meeting the candela requirements of ADA.
4. Polarized to allow electrical supervision.
5. Candela ratings: Selectable 15, 30, 75, 110, with visual indicator.
6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
7. Provide specific unit that allows for Slow Whoop audible signal.
8. Red face plate with white letters.

B. Strobe lights shall be similar to Wheelock #RSS24MC-WFR and shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.
4. Where more than one strobe is visible in one location, synchronization shall be required.
5. Candela ratings: Selectable 15, 30, 75, 110, with visual indicator.
6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
7. Red face plate with white letters.

C. Mini-Horn/Strobes: Combination Audible/Visible signals shall be similar to Wheelock #MT series.
1. Peak sound output: 90 dBA.
2. Ability to silence the horn while leaving the visible signal active.
3. Capable of meeting the candela requirements of ADA.
4. Polarized to allow electrical supervision.
5. Candela ratings: Selectable 15, 30, 75, 110, with visual indicator.

6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
7. Provide specific unit that allows for Slow Whoop audible signal.
8. Red face plate with white letters.
9. MINI-Units in small rooms and where indicated: Use lowest sounding level setting.

2.4 SYSTEM COMPONENTS - INTELLIGENT

A. Addressable Devices - General:
1. Addressable devices shall maintain decade (numbered 0 to 15 and 0 to 9) type address

switches.

2. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the FACP signaling line circuit.
3. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LED's. Both LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LED's shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
4. Smoke detector sensitivity shall be set in the fire alarm control panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
5. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
6. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
7. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
8. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
9. Detectors shall operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
10. Addressable devices shall provide address-setting means using decimal switches and shall also store use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
11. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

B. Addressable Pull Box (Manual Station):

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1/75 inches or larger.
4. Stations shall be suitable for surface mounting or semiflush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

5. Manual boxes shall be the double action type.

C. Intelligent Photoelectric Smoke Detector: The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors: Thermal detectors shall be intelligent addressable devices rated at 135EF. (58EC.) And have a rate-of-rise element rated at 15EF. (9.4EC.) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Intelligent Duct Smoke Detector:
1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, that provides continuous analog monitoring and alarm verification from the panel. Include sampling tube.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
3. Whether shown on plans or not, all air handling systems operating at 2000 CFM and above shall have duct mounted smoke detection equipment in accordance with the requirements of NFPA 90A. See Air Handling Schedules on Mechanical drawings. Provide labeled remote test and indicating stations at the fire alarm control panel. Use Photoelectric type detector with duct housing and relays plus appropriate sampling tubes cut to length (width of duct).

F. Addressable Dry Contact Monitor Module (FMM): shown on drawings as AMM (Addressable Monitor Module).
1. Addressable monitor modules shall be provided to connect supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone may be wire for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

G. Addressable Control Module (FCM):shown on drawings as ARM (Addressable Relay Module
1. Addressable control module shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.

H. Isolator Module:

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

I. Serially Connected Annunciator Requirements:

1. The annunciator shall communicate to the fire alarm control node or INA via an EIA-485 (multi-drop) two wire communications loop. The FACP node shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 64 points, may be connected to connections, for a system capacity of 2,048 points of annunciation.
2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. An optional (UL 864 listed) version shall allow the EIA-485 circuit to be transmitted over Fiber optics.
3. Annunciator switches may be programmed for system control such as global acknowledge, global signal silence, global system reset, and on/off control of any control point in the system.
4. An optional module shall be available utilizing annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 2,048 remote contacts.

J. LCD Alphanumeric Display Annunciator (at remote locations):

1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions from either the network node or complete network, via the INA.
3. Up to 32 LCD annunciators may be connected to a specific (terminal node) EIA-485 interface. LCD annunciators shall not reduce the annunciation capacity of the system. Each LCD shall include vital system wide functions such as system acknowledge, silence and reset.
4. LCD display annunciators shall mimic the local control panel 80 character display or network annunciator and shall not require special programming.
5. Annunciator control switches for system acknowledge, signal silence, drill and reset, and localized smoke evacuation control shall be key enabled. Provide 2 keys for Owner and 2 keys for the Fire Department. (Localized smoke evacuation control shall be a Smoke Control Station with AON-OFF-AUTO@ functions to control the respective exhaust and supply units, see the Special programable features paragraph above.)
6. Provide remote voice evacuation microphone station at the remote annunciators and in the gymnasium and auditorium.
7. AT the designated annunciator, provide a graphic annunciator of the building foot print (@1"=20' scale) with alpha numeric engraved labels indicating locations for all devices.

graphic annunciator shall have all devices located for all levels and areas. The alpha-numeric display and the graphic annunciator shall be both coordinated to show initiation location by zone, area, floor, room name, device description and device number. The Aarea@ shall be as indicated on the contract documents. The graphic annunciator shall be framed and permanently secured to wall. Exact location and layout as approved by shop drawing submittal and the fire department. The graphic annunciator shall meet fire department standards. The graphic annunciator shall have the building foot print Ain phase with the viewer and shall indicate in RED to the viewer AYOU ARE HERE@A. Graphic annunciator panel detail plan and drawing shall be submitted to the Exeter Fire Department for approval before installation.

K. LCD Alphanumeric Display Annunciator (within panel):

1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of 640 characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions from either the network node or complete network, via the INA.
3. Up to 32 LCD annunciators may be connected to a specific (terminal node) EIA-485 interface. LCD annunciators shall not reduce the annunciation capacity of the system. Each LCD shall include vital system wide functions such as system acknowledge, silence and reset.
4. Annunciator control switches for system acknowledge, signal silence, drill and reset shall be key enabled. Provide 2 keys for Owner and 2 keys for the Fire Department. All panel locks shall accept Gamewell, Simplex or FCI key.

2.5 BATTERIES

A. Sealed lead calcium type capable of operation of the system under supervisory conditions for a minimum of 60 hours after power failure and capable of operating the alarm devices for 15 minutes during the 60 hour period. IF batteries do not fit in control panels, then remotely mount in battery cabinet in nearest storage/mech room.

2.6 AUXILIARY DEVICES

A. Provide and install interface relays with number of poles as required (in no event less than three poles). Relays shall be Allen-Bradley, or approved equal, Bulletin 700, Type "BR" series, 120 volt coil in NEMA I enclosures. Paint enclosure red and mark "Fire Alarm Relay."

B. Provided two remote relay modules (Notifier ACM-8R).

2.7 FIELD CHARGING POWER SUPPLY (FCPS) may also be shown on the drawings as NAPX NOTIFICATION APPLIANCE POWER EXTENDER.

A. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 8.0 amps of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount back box.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
5. The FCPS include power limited circuitry, per 1995 UL standards.
6. Provide quantity as required to serve devices shown on plans. Locate in mechanical, electrical, storage rooms or as indicated. Extend circuit from nearest emergency panelboard 120V, 20A, spare breaker. Intent is to distribute the loads to limit wire runs and voltage drop.

2.8 RADIO MASTER BOX

A. RADIO MASTER BOX: AES #7788F as approved by the Fire Department. Master fire alarm box shall be of the wireless alarm monitoring type with the following features (but not limited to):
1. Built-in power supply and battery charger.
2. Locking cabinet (fire red).
3. Antenna as required for proper operation.
4. Tamper switch - GRI #TSW-01S.

2.9 FIRE ALARM WIRE AND CABLE

A. Fire Alarm Power Branch Circuits: Specified in Division 26 Section “Wire and Cable”.

B. Alarm System Wiring Within Building: Minimum size #16 AWG for initiating circuits and #14 AWG for alarm signal circuits, all copper-THWN, except as noted. Non power-limited wiring and exposed wiring shall be in rigid conduit or electrical metallic tubing or flexible metal conduit in accordance with Specifications for locations used, see Division 26 Section “Wire and Cable”: Wiring Methods. Concealed power limited wiring in dry locations above ceilings, in attic space, in stud walls, except as noted, shall be fire resistant teflon covered cables approved for use in an air plenum for fire alarm system.
1. Cables shall be properly supported, labeled and tie wrapped.

2. Complete installation shall meet requirements of NEC Article 760 "Fire Protective Signaling Systems."
3. Cables shall be separated from any conductors of power or class 1 circuits and shall not enter in same conduits or J-boxes.

C. SLC Multiplex Communication Loop: Twisted shielded pair sized per manufacturer and installed in conduit.

D. Telephone Circuits: Twisted shielded pair sized per manufacturer.

E. All wiring shall be per manufacturers recommendations for load and length required.

2.10 ENCLOSURES

A. Control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and the manufacturer=s standard finish. Mount flush in finished areas. All panel locks shall accept Gamewell, Simplex or FCI key.

2.11 BEACON

A. BEACON: Edwards 48FINR-N5-255WH, red, 25watt flashing beacon 120V, 0.2 amps.

B. Locate above remote annunciator ad directed by Fire Department.

2.12 FIREMAN'S KEY BOX

A. Fireman's Key Boxes: Supra - Recessed with tamper switch and high security lock to match Fire Department standards. Or Knox Box as approved by Fire Department.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Wiring shall be concealed in walls and above ceilings. Wiring in exposed construction shall be enclosed in conduit and run along structural members and painted to match.

C. Minimum size conduit: 3/4 inch. Refer to above paragraph: FIRE ALARM WIRE AND CABLE.

D. Install manual station with operating handle 48 inches above floor. Install audible and visual signal devices 80 inches above floor, or 6@ below ceiling whichever is lower, except as noted.

E. Smoke detectors shall not be installed prior to system programming and testing period. If construction is on going during this period, then protect the smoke detectors from contamination and physical damage.

F. Make conduit and wiring connections to sprinkler flow switches, sprinkler valve tamper switches, duct smoke detectors.

G. Automatic Detector Installation: Per NFPA 72.

H. Provide nameplates identifying all equipment, junction boxes and controls. Paint all junction boxes red.

I. Wiring Color Code: See Division 26 Section "Electrical Identification".

J. All devices and panels shall be flush mounted in finished areas and may be surface mounted in unfinished areas such as storage rooms. Where devices are surface mounted, the back box shall be a cast red box designed to mate with the device for a smooth appearance.

K. Provide Beacon (red, 25watt flashing beacon) mounted above the remote annunciator to flash upon the activation of the interior fire protection system.

L. At master box provide minimum of two ground rods with a box connecting rod or a #12 AWG solid copper wire, enclosed in conduit, connect to ground terminal of the Master Box. Resistance of ground connection shall not exceed 25 ohms.

M. Coordinate with the fire department for proper connection and reporting of radio master box.

N. Wire installation shall be inspected by the fire department. Coordinate and ask for inspections from the fire department.

O. Factory Trained, licensed authorized technical representative of the manufacturer of the equipment shall adjust taps after installation to meet code requirements.

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide the services of a Factory Trained, licensed authorized technical representative of the manufacturer of the equipment to supervise the installation and final connections, plus adjusting, programming and all testing of the system required to assure a complete and fully operative facility in accordance with the specifications; and to instruct designated personnel in the operation, adjustment, testing and maintenance of the system. Provide letter certifying results of test.

B. Include testing at substantial completion, at 6 months after occupancy and again two weeks prior to end of first year warranty. (Total of 3 complete documented tests). Invite the Owner, Architect and Local Fire Department to witness each test.

C. Include testing of the fire alarm system audio/visual devices to assure that the signals are operating according to the guidelines set by the NFPA 72 and the Americans with Disabilities Act (ADA).
   1. The limitations are as follows: NFPA - Audible signals intended for operation in the public mode should have a sound level of not less than 75 dBA at 10 feet or more than 130 dBA at the minimum hearing distance from the audible appliance. ADA - Audible emergency alarms shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15 dBA or exceeds any maximum sound level with a duration of 60 seconds by 5 dBA, whichever is louder. Sound levels for alarm signals shall not exceed 120 dBA.@
   2. Test the audio/visual units and make adjustments where required, including setting volume of horns and replacing strobes with proper intensity level. If horns are not adjustable then replace for proper dB level. Submit findings in writing, with areas marked that do not meet criteria after adjustments have been made.

3.3 FIELD TEST

A. Test in accordance with NFPA 72 and local fire department requirements. See Submittals item above.

B. Test shall include but not be limited to:
1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
3. Verify activation of all flow switches.
4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open signaling line circuits and verify that the trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Open and short (wire only) network communications and verify that trouble signals are received at network annunciators or reporting terminals.
8. Ground initiating device circuits and verify response of trouble signals.
9. Ground signaling line circuits and verify response of trouble signals.
10. Ground notification appliance circuits and verify response of trouble signals.
11. Check alert tone and prerecorded voice message to all alarm notification devices.
12. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
13. Each of the alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control panel points.
14. When the Vendor determines that the system must be equipped with optional features to satisfy this specification, the manufacturer’s manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.4 FINAL INSPECTION

A. A factory trained representative shall demonstrate that the system functions as specified.

B. Demonstrate in the presence of the Owner, Local Fire Chief, and the contractor. Invite the Architect's representative.

3.5 INSTRUCTIONS

A. In addition to the site training on programming features previously specified, provide minimum of two four hour periods to instruct the owner in the proper operation and maintenance requirements of the system. Provide one four hour period at substantial completion (after all testing and the system is fully operational and accepted by the fire department) and the other four hour period six months after substantial completion.

B. Provide a typewritten, bound, laminated Sequence of Operation to the Owner.

END OF SECTION 260721

SECTION 260741 – TELEPHONE/DATA SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Voice/data outlets.

B. Terminal Blocks.

C. Backboards and Panels.

D. Wire and Cable.

E. Interior Raceways and Junction Boxes, Including Final Connections to Telephone/Data Outlets and Terminal Blocks.

1.2 RELATED SECTIONS

A. Division 06 Section “Rough Carpentry.”

B. Division 09 Section “Interior Painting: Field Painting of Backboards and Cabinets.”

C. Division 26 Section “Basic Electrical Requirements.”

D. Division 26 Section “Conduit.”

E. Division 26 Section “Boxes.”

F. Division 26 Section “Electrical Identification.”

G. Division 26 Section “Wiring Devices”

1.3 QUALITY ASSURANCE

A. Install work in accordance with Telephone Utility Company's rules and regulations.

1.4 QUALIFICATIONS

A. Installer:
   1. Company specializing in the installation of Telephone/Data system wiring with minimum five years experience.
   2. Company offering service contracts for continuing service after the initial warranty period.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include racks, patch panels, terminal blocks, devices, wire and cable, and details of labeling.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12x12x6 inches, racks, backboard and panels.

B. Accurately record actual routing of conduits 2 inches and larger and cables containing 25 pairs or more. Indicate dimension from nearest column lines on As-Built Drawings.

1.7 PROJECT CONDITIONS

A. The Telephone Service: Commence at the Plaza Utility room.

B. Wire and cable routing is generally not shown on Drawings. Route wire and cable as required to meet project conditions.

C. Determine exact routing, number of conductors and lengths required.

1.8 COORDINATION

A. Locate such that outlets are readily accessible.

B. Determine required separation between cables and other work.

C. Determine cable routing to avoid interference with other work

D. Verify exact device type and configuration plus color coding with USPS Standards prior to shop drawing submittals.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Material: APA Plywood Grade AC.

B. Size: 3/4 inch thick, 4 x 8 feet for main backboard, minimum 4x4 feet for satellite backboards or as shown on Drawings.

C. Paint all sides two coats Dark Gray.

2.2 TERMINAL BLOCKS

A. Acceptable Manufacturers:
   1. AT&T, Model #110 Series.
   2. Leviton.

B. Wiring Block: Fire-retardant molded plastic, 100 pair block with horizontal index strips to secure 25 cable pairs each.
   1. Self-supporting with legs to provide space behind the block for cables terminated on the wiring block and space on the sides for vertical jump through.

2. Index Strips: Designed to accept 22 through 26 gauge conductors and marked with five tip colors.

C. Connecting Block: 4-pair insulation displacement 1-piece fire-retardant plastic double ended unit.
1. Termination End: Solder-plated quick clips that cut through the insulation when pushed onto the wiring block.
2. Cross Connect End: Designed to accept 22 through 26 gauge wires without removing the insulation.
3. Front color coded.
4. Quantity as required to cover all index strips specified.

D. As a minimum, provide number of blocks to receive all outlets shown plus 50%.

2.3 DATA DISTRIBUTION RACKS –WALL MOUNTED

A. Distribution Rack Assembly: Side hinge wall mount bracket for mounting 19" panels. Bracket shall swing beyond 90° to allow full access to rear of components.
1. 16 ga. Steel construction.
2. Black powder coat finish.
3. Mounting holes 16" on centers.
4. EIA-310-D universal spacing tapped #12-24.
5. 19" width.
6. Load Capacity:
   a. 4 and 6 rack units: 50 lbs.
   b. 1 and 2 rack units: 25 lbs.

B. Racks shall be similar to Hubbell HPWWB## series.

C. Provide number of racks as required to accommodate patch panels

2.4 PATCH PANELS - Cat 6
1. Rack mounted 24-port Hubbell Nextspeed Universal Patch Panel, Category 6, one rack unit high (1UPPP), #P6E24U.
2. Provide number of patch panels as required to terminate all cables indicated on plans plus 25% spare ports for future terminations.

2.5 DEVICES – TELEPHONE & DATA

A. Acceptable Manufacturers:
1. Hubbell.
2. Or Equal.

B. Category 6 Jacks (DATA):
1. Modular type jack, yellow, single punch termination, Hubbell #HXJ6Y.

C. Category 3 Jacks (TELEPHONE)
1. Modular type jack, white, single punch termination, Hubbell #HXJ3W.

D. Eight (8) conductor configuration for voice and eight (8) conductor configuration for data.

E. Each jack engraved with "VOICE" and "DATA".

F. Faceplate: modular type with three openings (all locations), Hubbell IFP series. Provide blanks in all unused openings.

G. Color of Device: Same as device specified under Division 26 Section – "Wiring Devices": Duplex Receptacles.

H. Wall Boxes: Single gang as specified under Division 26 Section – "Boxes."

2.6 WALL MOUNT PHONE PLATES – SINGLE

A. Designed for use with wall mount telephones, corrosion resistant, durable, shall mount on any wall box.
   1. Hubbell #P630SR1GJ8.

2.7 WIRE AND CABLE

A. Acceptable Manufacturers:
   1. Cable manufacturers certified as Hubbel Cable Partners including:
   2. Comm Scope, General Cable, Mohawk/CDT, Superior Essex, Berk-Tek

B. Category 3 Copper Cable:
   1. 100 Ohm, 4 pair, 24 gauge, UTP conforming to Category 3, ANSI/TIA/EIA-568A, NEMA WC63.1.
   2. UL MPR/CMR, Non-Plenum, Riser-Rated.
   3. Flame retardant PVC jacket. Jacket color: Gray.
   4. Graybar/General Cable #3NP4P24-GY-P-GCC-PV.
   5. Mohawk/CDT #PVC 93170735
   6. Riser cables between comm rooms: Similar except with pair counts as indicated on drawing E50.1. Groups of 25 pair within the outer jacket shall be separated by color coded binders.

C. Category 6 enhanced Copper Cable:
   1. 100 Ohm ballanced, 4 pair, 24 gauge, UTP Category 6 enhanced
   2. UL MPR/CMR, Non-Plenum, Riser-Rated.
   3. Flame retardant PVC jacket. Jacket color: Yellow.
   4. Graybar/General Cable #6EXHNP4P24-YL-S-GCC-PV.
   5. Mohawk/CDT Advancenet CAT6 #PVC99723536

D. Voice and data wiring shall be kept separate and not enter same jacket and shall be terminated at separate labeled terminal blocks.

E. Areas Used As Air Plenums: Fire-resistant teflon cable approved for use in an air plenum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on Drawings.

C. Verify that building is watertight before start of installation. Do not install cable until building is water- tight.

3.2 INSTALLATION

A. Install conduit minimum 3/4" C or as noted from accessible ceilings to each wall outlet. In locations of exposed structure, provide conduit path to above an accessible (concealed) ceiling.

B. In all locations where tel/data outlets are indicated provide both category 3 and category 6 cables from outlet location to patch panel location. Terminate at both ends.

C. Properly support raceways, backboards, and panels. Coordinate with Division 06 Section – "Rough Carpentry" to provide blocking as required.

D. Install terminal blocks, backboards plumb, and attach securely at each corner.

E. Install polyethylene pulling string in each empty conduit.

F. Mark all backboards with the legend "TELEPHONE" and "DATA" above the appropriate blocks under the provisions of Division 26 Section "Electrical Identification."

G. Tag cables at the terminal block end to designate the location of the outlet: i.e. Rm #101-N (Room Number 101 north wall).

H. Install all devices in wall boxes.

I. Color Coding of Individual Wires for Voice and Data Outlet (Note that solid colors twisted with solid white to identify the color coding is not acceptable):

Tip & Ring	Wire Color	Device Term.#	RJ45 Pin #
T1	White/Blue	1	5
R1	Blue/White	2	4
T2	White/Orange	3	1
R2	Orange/White	4	2
T3	White/Green	5	3
R3	Green/White	6	6
T4	White/Brown	7	7
R4	Brown/White	8	8

J. Install minimum 50-pair cable between backboards or size as shown on the Drawings, whichever is greater.

K. Concealed wiring in dry locations above ceilings, in Attic space, in stud walls, except as noted may be run without conduit.
   1. Provide conduit or tubing sleeves when passing through walls and floors and in masonry block walls, and from accessible ceilings to walls outlets. Provide bushing at end of each conduit stub.
   2. Cable shall be installed along beams, joists, etc.; if run perpendicular to joists, rafters, etc., cable shall be installed on running boards.

3. Cables shall be properly secured in place. Support cables above accessible ceiling, using spring metal clips or approved cable ties to support cables from structure. Do not support from ceiling suspension system. Do not rest cable on ceiling panels. Do not drape over ductwork or between bar joists. Wiring shall not be run diagonally and shall be cabled neatly.

END OF SECTION 260741