

**MEDICAL UNIVERSITY OF SOUTH CAROLINA
STORM EYE INSTITUTE OPTICAL SHOP**

167 Ashley Ave., Charleston, SC 29425
H51-50068

Volume 1 of 1



**Rosenblum Coe Architects, Inc.
1643 Means Street
Charleston, SC 29412
(843) 577-6073**

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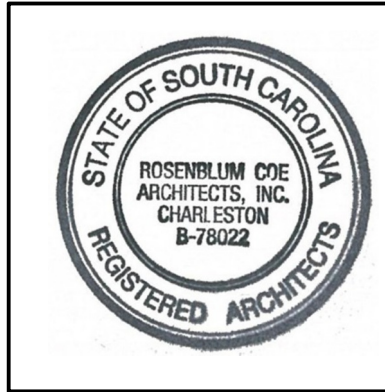
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1.1 DESIGN PROFESSIONALS OF RECORD

PRIME ARCHITECT
ROSENBLUM COE ARCHITECTS, INC.
Steven H. Coe, AIA, LEED BD+C
License #: AR. 5573

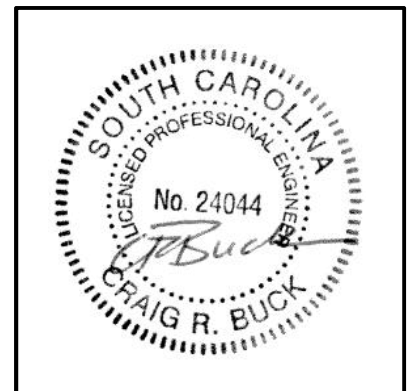
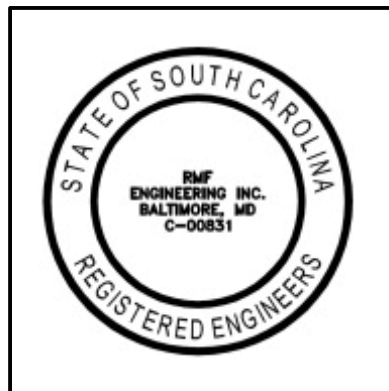
Firm Seal if Applicable



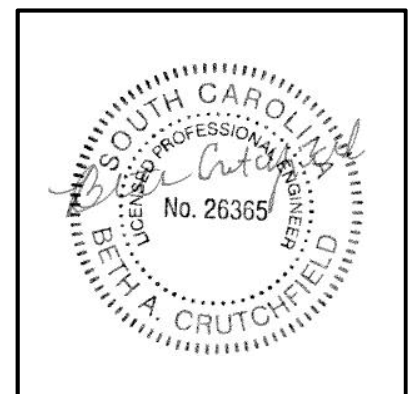
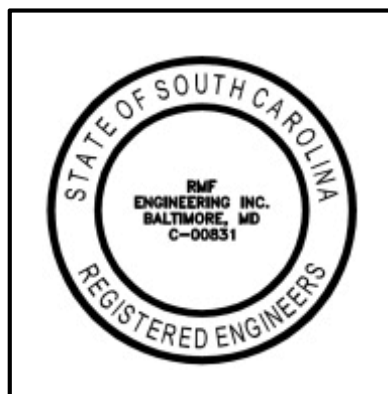
Individual Seal



MECHANICAL ENGINEER
RMF ENGINEERING
Craig R. Buck, PE, LEED AP
License #: 24044
Divisions: 21, 22, 23



ELECTRICAL ENGINEER
RMF ENGINEERING
Beth A. Crutchfield, PE
License #: 26365
Divisions: 26, 27



END OF DOCUMENT

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Storm Eye Institute Optical Shop, dated 30 March 2018, as modified by subsequent Addenda and Contract modifications.
- B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

| | |
|-------|--------------------------------------------------|
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| PD100 | PLUMBING CRAWL SPACE DEMOLITION PLAN |
| PD101 | PLUMBING FIRST FLOOR DEMOLITION PLAN |
| P100 | PLUMBING CRAWL SPACE PLAN |
| P101 | PLUMBING FIRST FLOOR PLAN |
| P201 | PLUMBING RISER DIAGRAM |
| P301 | PLUMBING DETAILS |
| M001 | MECHANICAL NOTES, SYMBOLS AND ABBREVIATIONS |
| MD101 | MECHANICAL DEMOLITION FIRST FLOOR PLAN |
| M101 | MECHANICAL FIRST FLOOR PLAN |
| M201 | MECHANICAL DETAILS AND CONTROLS |
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| ED101 | ELECTRICAL DEMOLITION PLAN |
| E101 | ELECTRICAL POWER AND SPECIAL SYSTEMS PLAN |
| E201 | ELECTRICAL LIGHTING PLAN |
| E601 | ELECTRICAL SCHEDULES |
| FP001 | FIRE PROTECTION NOTES, SYMBOLS AND ABBREVIATIONS |
| FP101 | FIRE PROTECTION FLOOR PLAN |
| PF201 | FIRE PROTECTION SCHEDULES |
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END OF DOCUMENT 000115

SE-310

INVITATION FOR DESIGN-BID-BUILD CONSTRUCTION SERVICES

AGENCY/OWNER: Medical University of South CarolinaPROJECT NAME: Storm Eye Institute Optical ShopPROJECT NUMBER: H51-50068PROJECT LOCATION: Medical University of South Carolina, Charleston, SC

DESCRIPTION OF PROJECT/SERVICES: Selective demo and 2-phase renovation of existing 1st floor waiting area for new Optical Shop. Phase 1 renovates existing exam areas into new waiting area and 2 new exam rooms. Phase 2 will be to renovate the original waiting area into a new optical display/sales area. Project includes architectural, mechanical, electrical and fire protection and includes installation of new fire rated glass wall. Contractor required to coordinate installation of casework provided/installed by Owner's vendor.

BID/SUBMITTAL DUE DATE: 5/31/2018 CONSTRUCTION COST RANGE: \$ \$100,000 to \$ 500,000 N/A

PROJECT DELIVERY METHOD: Design-Bid-Build

BID SECURITY IS REQUIRED IN AN AMOUNT NOT LESS THAN 5% OF THE BASE BID.

PERFORMANCE BOND REQUIRED? Yes No PAYMENT BOND REQUIRED? Yes No

BIDDING DOCUMENTS/PLANS MAY BE OBTAINED FROM:

http://academicdepartments.musc.edu/vpfa/eandf/construction_projects/index.html

PLAN DEPOSIT AMOUNT: \$ 0.00 IS DEPOSIT REFUNDABLE Yes No N/A

Bidders must obtain Bidding Documents/Plans from the above listed source(s) to be listed as an official plan holder. Bidders that rely on copies obtained from any other source do so at their own risk. All written communications with official plan holders & bidders will be via email or website posting.

All questions & correspondence concerning this Invitation shall be addressed to the A/E.

A/E NAME: Rosenblum Coe Architects, Inc.A/E CONTACT: Ryan Lewis, Assoc. AIAA/E ADDRESS: Street/PO Box: 1643 Means St.City: CharlestonState: SCZIP: 29412-EMAIL: rlewis@rosenblumcoe.comTELEPHONE: 843.577.6073AGENCY PROJECT COORDINATOR: Mr. Wade Lewis GatlinADDRESS: Street/PO Box: 97 Jonathan Lucas St.City: CharlestonState: SCZIP: 29425-1900EMAIL: gatlin@musc.eduTELEPHONE: 843.792.2233PRE-BID CONFERENCE: Yes No MANDATORY ATTENDANCE: Yes No PRE-BID DATE: 5/15/2018 TIME: 2:00pm PLACE: 97 Jonathan Lucas St., Conference Room 209BID DUE DATE: See Above TIME: 2:00pm PLACE: 97 Jonathan Lucas St., Conference Room 209

BID DELIVERY ADDRESSES:

HAND-DELIVERY:

Attn: Wade Lewis Gatlin, AIA MUSC Engineering & Facilities97 Jonathan Lucas St., Conference Room 209Charleston, SC 29425

MAIL SERVICE:

Attn: Wade Lewis Gatlin, AIA Engineering & Facilities97 Jonathan Lucas Street, MSC 190Charleston, SC 29425-1900

IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? (Agency MUST check one) Yes No

APPROVED BY: Wade Lewis Gatlin

(OSE Project Manager)

DATE: 5.09.18



AIA[®] Document A701[™] – 1997 Instructions

Instructions to Bidders

GENERAL INFORMATION

Purpose. AIA Document A701[™]–1997 and AIA Document A201[™], General Conditions of the Contract for Construction, have complementary provisions and are intended to be used together in the project manual in competitively bid projects.

Related Documents. This document is complementary to, and has been prepared for use with, AIA Document A201. It may also be used with AIA Document A232[™]–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition. Specific information for a particular Project must be provided in the Advertisement or Invitation to Bid, in the Supplementary Provisions provided for the Project, or in a supplement to this document. Another set of Instructions to Bidders, AIA Document A771[™], is published by the AIA for use on projects involving interiors work.

Why Use AIA Contract Documents. AIA contract documents are the product of a consensus-building process aimed at balancing the interests of all parties on the construction project. The documents reflect actual industry practices, not theory. They are state-of-the-art legal documents, regularly revised to keep up with changes in law and the industry—yet they are written, as far as possible, in everyday language. Finally, AIA contract documents are flexible: they are intended to be modified to fit individual projects, but in such a way that modifications are easily distinguished from the original, printed language.

Use of Non-AIA Forms. If a combination of AIA documents and non-AIA documents is to be used, particular care must be taken to achieve consistency of language and intent among documents.

Use of Current Documents. Prior to using any AIA Contract Document, users should consult www.aia.org or a local AIA component to verify the most recent edition.

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CHANGES FROM THE PREVIOUS EDITION

The following changes in content have been made in A701–1997 on the recommendation of AIA members, contractors, legal and insurance counsel, and users of the document.

Article 1. The definition of a Bidder has been clarified by the addition of the requirement that the person or entity meet the requirements set forth in the Bidding Documents.

Article 2. Repetition of the statement that the Bidder has read and understands the Bidding Documents has been eliminated.

Article 3. The requirement that Addenda be “mailed or delivered” has been changed to “transmitted” to reflect alternative methods of delivery.

Article 4. Bids are now required to be submitted on the forms actually included with the Bidding Documents. The requirement that the bid form be filled in by typewriter or manually in ink has been changed to require only that the bid form shall be executed legibly in a non-erasable medium. It is mandatory that sums be expressed in both words and figures. A requirement that the Bidder provide evidence of legal authority to perform within the jurisdiction of the work has been added. Facsimile and other electronically transmitted bids are disallowed in the same manner as oral, telephonic and telegraphic bids. Withdrawal of a bid via telegram is no longer allowed.

Article 5. The intent of the Owner to award a Contract to the lowest qualified Bidder has been clarified.

Article 6. The date for furnishing of submittals may now be stipulated in the Bidding Documents.

USING A701-1997

Modifications. Particularly with respect to professional or contractor licensing laws, building codes, taxes, monetary and interest charges, arbitration, indemnification, format and font size, AIA Contract Documents may require modification to comply with state or local laws. Users are encouraged to consult an attorney before completing or modifying a document.

In a purchased paper AIA Contract Document, necessary modifications may be accomplished by writing or typing the appropriate terms in the blank spaces provided on the document, or by attaching Supplementary Conditions, special conditions or referenced amendments.

Modifications directly to purchased paper AIA Contract Documents may also be achieved by striking out language. However, care must be taken in making these kinds of deletions. Under NO circumstances should standard language be struck out to render it illegible. For example, users should not apply blocking tape, correction fluid or Xs that would completely obscure text. Such practices may raise suspicion of fraudulent concealment, or suggest that the completed and signed document has been tampered with. Both parties should initial handwritten changes.

Using AIA software, modifications to insert information and revise the standard AIA text may be made as the software permits.

By reviewing properly made modifications to a standard AIA Contract Document, parties familiar with that document can quickly understand the essence of the proposed relationship. Commercial exchanges are greatly simplified and expedited, good faith dealing is encouraged, and otherwise latent clauses are exposed for scrutiny.

AIA Contract Documents may not be retyped or electronically scanned. Retyping can introduce typographic errors and cloud legal interpretation given to a standard clause. Furthermore, retyping and electronic scanning are not permitted under the user’s limited license for use of the document, constitute the creation of a derivative work and violate the AIA’s copyright.



AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Medical University of South Carolina
97 Jonathan Lucas St.
Charleston, SC 29425

BOND AMOUNT: \$**PROJECT:**

(Name, location or address, and Project number, if any)

MUSC Storm Eye Optical Shop
Charleston, SC

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so

ADDITIONS AND DELETIONS:

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

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

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

Init.

furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

(Witness)

(Witness)

(Contractor as Principal)

(Seal)

(Title)

(Surety)

(Seal)

(Title)

Init.

SE-330
LUMP SUM BID FORM

Bidders shall submit bids on only Bid Form SE-330.

BID SUBMITTED BY: _____

(Bidder's Name)

BID SUBMITTED TO: Medical University of South Carolina

(Owner's Name)

FOR: PROJECT NAME: Storm Eye Institute Optical Shop

PROJECT NUMBER: H51-50068

OFFER

§ 1. In response to the Invitation for Construction Services and in compliance with the Instructions to Bidders for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the Owner on the terms included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

§ 2. Pursuant to SC Code § 11-35-3030(1), Bidder has submitted Bid Security as follows in the amount and form required by the Bidding Documents:

Bid Bond with Power of Attorney Electronic Bid Bond Cashier's Check

(Bidder check one)

§ 3. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into this Bid:

(Bidder, check all that apply. Note, there may be more boxes than actual addenda. Do not check boxes that do not apply)

ADDENDA: #1 #2 #3 #4 #5

§ 4. Bidder accepts all terms and conditions of the Invitation for Bids, including, without limitation, those dealing with the disposition of Bid Security. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of 60 Days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner.

§ 5. Bidder herewith offers to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the following items of construction work:

§ 6.1 **BASE BID WORK** *(as indicated in the Bidding Documents and generally described as follows):* Selective demo and 2-phase renovation of existing 1st floor waiting area for new Optical Shop. Phase 1 renovates existing exam areas into new waiting area and 2 new exam rooms. Phase 2 will be to renovate the original waiting area into a new optical display/sales area. Project includes architectural, mechanical, electrical and fire protection and includes installation of new fire rated glass wall. Contractor required to coordinate installation of casework provided/installed by Owner's vendor

\$ _____, which sum is hereafter called the Base Bid.

(Bidder to insert Base Bid Amount on line above)

**SE-330
LUMP SUM BID FORM**

§ 7. LISTING OF PROPOSED SUBCONTRACTORS PURSUANT TO SECTION 3020(b)(i), CHAPTER 35, TITLE 11 OF THE SOUTH CAROLINA CODE OF LAWS, AS AMENDED
(See Instructions on the following page BF-2A)

Bidder shall use the below-listed Subcontractors in the performance of the Subcontractor Specialty Classification work listed:

| (A) SUBCONTRACTOR SPECIALTY <i>(Completed by Owner)</i> | (B) CLASSIFICATION or SUBCLASSIFICATION ABBREVIATION <i>(Completed by Owner)</i> | (C) SUBCONTRACTOR'S or PRIME CONTRACTOR'S NAME <i>(Required - must be completed by Bidder)</i> | (D) SUBCONTRACTOR'S or PRIME CONTRACTOR'S SC LICENSE NUMBER <i>(Requested, but not Required)</i> |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| BASE BID | | | |
| Air Conditioning | AC | | |
| Heating | HT | | |
| Electrical | EL | | |
| Plumbing | PB | | |
| ALTERNATE #1 | | | |
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| | | | |
| ALTERNATE #2 | | | |
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| ALTERNATE #3 | | | |
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| | | | |

If a Bid Alternate is accepted, Subcontractors listed for the Bid Alternate shall be used for the work of both the Alternate and the Base Bid work.

SE-330 LUMP SUM BID FORM

§ 8. LIST OF MANUFACTURERS, MATERIAL SUPPLIERS, AND SUBCONTRACTORS OTHER THAN SUBCONTRACTORS LISTED IN SECTION 7 ABOVE (*FOR INFORMATION ONLY*):

Pursuant to instructions in the Invitation for Construction Services, if any, Bidder will provide to Owner upon the Owner's request and within 24 hours of such request, a listing of manufacturers, material suppliers, and subcontractors, other than those listed in Section 7 above, that Bidder intends to use on the project. Bidder acknowledges and agrees that this list is provided for purposes of determining responsibility and not pursuant to the subcontractor listing requirements of SC Code § 11-35-3020(b)(i).

§ 9. TIME OF CONTRACT PERFORMANCE AND LIQUIDATED DAMAGES

a) CONTRACT TIME

Bidder agrees that the Date of Commencement of the Work shall be established in a Notice to Proceed to be issued by the Owner. Bidder agrees to substantially complete the Work within 120 Calendar Days from the Date of Commencement, subject to adjustments as provided in the Contract Documents.

b) LIQUIDATED DAMAGES

Bidder further agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the amount of \$ 500.00 for each Calendar Day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted time for Substantial Completion as provided in the Contract Documents. This amount is intended by the parties as the predetermined measure of compensation for actual damages, not as a penalty for nonperformance.

§ 10. AGREEMENTS

- a) Bidder agrees that this bid is subject to the requirements of the laws of the State of South Carolina.
- b) Bidder agrees that at any time prior to the issuance of the Notice to Proceed for this Project, this Project may be canceled for the convenience of, and without cost to, the State.
- c) Bidder agrees that neither the State of South Carolina nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the Project canceled for any reason prior to the issuance of the Notice to Proceed.

§ 11. ELECTRONIC BID BOND

By signing below, the Principal is affirming that the identified electronic bid bond has been executed and that the Principal and Surety are firmly bound unto the State of South Carolina under the terms and conditions of the AIA Document A310, Bid Bond, included in the Bidding Documents.

ELECTRONIC BID BOND NUMBER: _____

SIGNATURE AND TITLE: _____

**SE-330
LUMP SUM BID FORM**

CONTRACTOR'S CLASSIFICATIONS AND SUBCLASSIFICATIONS WITH LIMITATION

SC Contractor's License Number(s): _____

Classification(s) & Limits: _____

Subclassification(s) & Limits: _____

By signing this Bid, the person signing reaffirms all representation and certification made by both the person signing and the Bidder, including without limitation, those appearing in Article 2 of the SCOSE Version of the AIA A701, Instructions to Bidders, is expressly incorporated by reference.

BIDDER'S LEGAL NAME: _____

ADDRESS: _____

TELEPHONE: _____

EMAIL: _____

SIGNATURE: _____ DATE: _____

PRINT NAME: _____

TITLE: _____

The Form of the Contract shall be the SCOSE Version of the AIA Documents A101-2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, which is incorporated herein by reference.

Samples of these documents may be viewed a

<http://procurement.sc.gov/PS/vendor/PS-vendor-ose-news-phtm>

**SE-330
LUMP SUM BID FORM**

Bidders shall submit bids on only Bid Form SE-330.

BID SUBMITTED BY: _____
(Bidder's Name)

BID SUBMITTED TO: Medical University of South Carolina
(Owner's Name)

FOR: PROJECT NAME: Storm Eye Institute Optical Shop
PROJECT NUMBER: H51-50068

OFFER

§ 1. In response to the Invitation for Construction Services and in compliance with the Instructions to Bidders for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the Owner on the terms included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

§ 2. Pursuant to SC Code § 11-35-3030(1), Bidder has submitted Bid Security as follows in the amount and form required by the Bidding Documents:

- Bid Bond with Power of Attorney Electronic Bid Bond Cashier's Check
(Bidder check one)

§ 3. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into this Bid:

(Bidder, check all that apply. Note, there may be more boxes than actual addenda. Do not check boxes that do not apply)

- ADDENDA:** #1 #2 #3 #4 #5

§ 4. Bidder accepts all terms and conditions of the Invitation for Bids, including, without limitation, those dealing with the disposition of Bid Security. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of **60** Days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner.

§ 5. Bidder herewith offers to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the following items of construction work:

§ 6.1 **BASE BID WORK** *(as indicated in the Bidding Documents and generally described as follows):* Selective demo and 2-phase renovation of existing 1st floor waiting area for new Optical Shop. Phase 1 renovates existing exam areas into new waiting area and 2 new exam rooms. Phase 2 will be to renovate the original waiting area into a new optical display/sales area. Project includes architectural, mechanical, electrical and fire protection and includes installation of new fire rated glass wall. Contractor required to coordinate installation of casework provided/installed by Owner's vendor

\$ _____, which sum is hereafter called the Base Bid.
(Bidder to insert Base Bid Amount on line above)

SE-330
LUMP SUM BID FORM

§ 7. LISTING OF PROPOSED SUBCONTRACTORS PURSUANT TO SECTION 3020(b)(i), CHAPTER 35, TITLE 11 OF THE SOUTH CAROLINA CODE OF LAWS, AS AMENDED
(See Instructions on the following page BF-2A)

Bidder shall use the below-listed Subcontractors in the performance of the Subcontractor Specialty Classification work listed:

| (A) SUBCONTRACTOR SPECIALTY <i>(Completed by Owner)</i> | (B) CLASSIFICATION or SUBCLASSIFICATION ABBREVIATION <i>(Completed by Owner)</i> | (C) SUBCONTRACTOR'S or PRIME CONTRACTOR'S NAME <i>(Required - must be completed by Bidder)</i> | (D) SUBCONTRACTOR'S or PRIME CONTRACTOR'S SC LICENSE NUMBER <i>(Requested, but not Required)</i> |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| BASE BID | | | |
| Air Conditioning | AC | | |
| Heating | HT | | |
| Electrical | EL | | |
| | | | |
| ALTERNATE #1 | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| ALTERNATE #2 | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| ALTERNATE #3 | | | |
| | | | |
| | | | |
| | | | |
| | | | |

If a Bid Alternate is accepted, Subcontractors listed for the Bid Alternate shall be used for the work of both the Alternate and the Base Bid work.

SE-330 LUMP SUM BID FORM

§ 8. LIST OF MANUFACTURERS, MATERIAL SUPPLIERS, AND SUBCONTRACTORS OTHER THAN SUBCONTRACTORS LISTED IN SECTION 7 ABOVE (*FOR INFORMATION ONLY*):

Pursuant to instructions in the Invitation for Construction Services, if any, Bidder will provide to Owner upon the Owner's request and within 24 hours of such request, a listing of manufacturers, material suppliers, and subcontractors, other than those listed in Section 7 above, that Bidder intends to use on the project. Bidder acknowledges and agrees that this list is provided for purposes of determining responsibility and not pursuant to the subcontractor listing requirements of SC Code § 11-35-3020(b)(i).

§ 9. TIME OF CONTRACT PERFORMANCE AND LIQUIDATED DAMAGES

a) CONTRACT TIME

Bidder agrees that the Date of Commencement of the Work shall be established in a Notice to Proceed to be issued by the Owner. Bidder agrees to substantially complete the Work within 120 Calendar Days from the Date of Commencement, subject to adjustments as provided in the Contract Documents.

b) LIQUIDATED DAMAGES

Bidder further agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the amount of \$ 500.00 for each Calendar Day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted time for Substantial Completion as provided in the Contract Documents. This amount is intended by the parties as the predetermined measure of compensation for actual damages, not as a penalty for nonperformance.

§ 10. AGREEMENTS

- a) Bidder agrees that this bid is subject to the requirements of the laws of the State of South Carolina.
- b) Bidder agrees that at any time prior to the issuance of the Notice to Proceed for this Project, this Project may be canceled for the convenience of, and without cost to, the State.
- c) Bidder agrees that neither the State of South Carolina nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the Project canceled for any reason prior to the issuance of the Notice to Proceed.

§ 11. ELECTRONIC BID BOND

By signing below, the Principal is affirming that the identified electronic bid bond has been executed and that the Principal and Surety are firmly bound unto the State of South Carolina under the terms and conditions of the AIA Document A310, Bid Bond, included in the Bidding Documents.

ELECTRONIC BID BOND NUMBER: _____

SIGNATURE AND TITLE: _____

**SE-330
LUMP SUM BID FORM**

CONTRACTOR'S CLASSIFICATIONS AND SUBCLASSIFICATIONS WITH LIMITATION

SC Contractor's License Number(s): _____

Classification(s) & Limits: _____

Subclassification(s) & Limits: _____

By signing this Bid, the person signing reaffirms all representation and certification made by both the person signing and the Bidder, including without limitation, those appearing in Article 2 of the SCOSE Version of the AIA A701, Instructions to Bidders, is expressly incorporated by reference.

BIDDER'S LEGAL NAME: _____

ADDRESS: _____

TELEPHONE: _____

EMAIL: _____

SIGNATURE: _____ **DATE:** _____

PRINT NAME: _____

TITLE: _____

The Form of the Contract shall be the SCOSE Version of the AIA Documents A101-2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, which is incorporated herein by reference. Samples of these documents may be viewed a

<http://procurement.sc.gov/PS/vendor/PS-vendor-ose-news-phtm>

**South Carolina Division of Procurement
Services, Office of the State Engineer Version of
 AIA Document A201™ – 2007**

General Conditions of the Contract for Construction

This version of AIA Document A201™–2007 is modified by the South Carolina Division of Procurement Services, Office of the State Engineer (“SCOSE”). Publication of this version of AIA Document A201–2007 does not imply the American Institute of Architects’ endorsement of any modification by SCOSE. A comparative version of AIA Document A201–2007 showing additions and deletions by SCOSE is available for review on the SCOSE Web site.

Cite this document as “AIA Document A201™–2007, General Conditions of the Contract for Construction—SCOSE Version,” or “AIA Document A201™–2007 — SCOSE Version.”

South Carolina Division of Procurement Services, Office of the State Engineer Version of AIA Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

Storm Eye Optical Shop
167 Ashley Avenue, Charleston, SC 29425

THE OWNER:

(Name, legal status and address)

Medical University of South Carolina
97 Jonathan Lucas St.
Charleston, SC 29425

The Owner is a Governmental Body of the State of South Carolina as defined by Title 11, Chapter 35 of the South Carolina Code of Laws, as amended.

THE ARCHITECT:

(Name, legal status and address)

Rosenblum Coe Architects, Inc.
1643 Means Street
Charleston, SC 29412

This version of AIA Document A201–2007 is modified by the South Carolina Division of Procurement, Office of the State Engineer. Publication of this version of AIA Document A201 does not imply the American Institute of Architects' endorsement of any modification by South Carolina Division of Procurement, Office of the State Engineer. A comparative version of AIA Document A201–2007 showing additions and deletions by the South Carolina Division of Procurement, Office of the State Engineer is available for review on the State of South Carolina Web site.

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

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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.

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean AIA Document A101™-2007 Standard Form of Agreement Between Owner and Contractor, SCOSE edition. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean AIA Document A201™-2007 General Conditions of the Contract for Construction, SCOSE edition.

§ 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.

§ 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 NOTICE TO PROCEED

The Notice to Proceed is a document issued by the Owner to the Contractor, with a copy to the Architect, directing the Contractor to begin prosecution of the Work in accordance with the requirements of the Contract Documents. The Notice to Proceed shall fix the date on which the Contract Time will commence.

§ 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. In the event of patent ambiguities within or between parts of the Contract Documents, the Contractor shall 1) provide the better quality or greater quantity of Work, or 2) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation.

§ 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 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 a violation 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 provided in Section 7.1.2. 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 Representative. [Reference § 8.3 of the Agreement.]

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen (15) days after receipt of a written request, information necessary and relevant for the Contractor to post Notice of Project Commencement pursuant to Title 29, Chapter 5, Section 23 of the South Carolina Code of Laws, as amended.

§ 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. Subject to the Contractor's obligations, including those in Section 3.2, the Contractor shall be entitled to rely on the accuracy of information furnished by the Owner pursuant to this Section 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; however, the Owner does not warrant the accuracy of any such information requested by the Contractor that is not otherwise required of the Owner by the Contract Documents. Neither the Owner nor the Architect shall be required to conduct investigations or to furnish the Contractor with any information concerning subsurface characteristics or other conditions of the area where the Work is to be performed beyond that which is provide in the Contract Documents.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one electronic copy (.pdf format) of the Contract Documents. The Contractor may make reproductions of the Contract Documents pursuant to Section 1.5.2.

§ 2.2.6 The Owner assumes no responsibility for any conclusions or interpretation made by the Contractor based on information made available by the Owner.

§ 2.2.7 The Owner shall obtain, at its own cost, general building and specialty inspection services as required by the Contract Documents. The Contractor shall be responsible for payment of any charges imposed for reinspections.

§ 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, including but not limited to providing necessary resources, 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 Directive 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. 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. The Contractor acknowledges that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Owner, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Owner.

§ 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 latent 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.

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§ 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 by the Owner in writing 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 shall be considered defective. Unless caused by the Contractor or a subcontractor at any tier, 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. The Contractor shall comply with the requirements of Title 12, Chapter 8 of the South Carolina Code of Laws, as amended, regarding withholding tax for nonresidents, employees, contractors and subcontractors.

§ 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 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. Pursuant to Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, no local general or specialty building permits are required for state buildings.

§ 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. Adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 7.3.3.

§ 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 the difference between actual costs, as documented by invoices, and the allowances under Section 3.8.2.1.

§ 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, acceptable to the Owner, 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 the name and qualifications of a proposed superintendent. The Owner may reply within 14 days to the Contractor in

writing stating whether the Owner has reasonable objection to the proposed superintendent. Failure of the Owner 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 notify the Owner, in writing, of any proposed change in the superintendent, including the reason therefore, prior to making such change. 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 Additional requirements, if any, for the constructions schedule are as follows:
(Check box if applicable to this Contract))

The construction schedule shall be in a detailed precedence-style critical path management (CPM) or primavera-type format satisfactory to the Owner and the Architect that shall also (1) provide a graphic representation of all activities and events that will occur during performance of the work; (2) identify each phase of construction and occupancy; and (3) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as "Milestone Dates"). Upon review and acceptance by the Owner and the Architect of the Milestone Dates, the construction schedule shall be deemed part of the Contract Documents and attached to the Agreement as Exhibit "A." If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner and the Architect and resubmitted for acceptance. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. Whenever the approved construction schedule no longer reflects actual conditions and progress of the work or the Contract Time is modified in accordance with the terms of the Contract Documents, the Contractor shall update the accepted construction schedule to reflect such conditions. In the event any progress report indicates any delays, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment in the Contract Time, any Milestone Date, or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to Change Order.

§ 3.10.4 The Owner's review and acceptance of the Contractor's schedule is not conducted for the purpose of either determining its accuracy and completeness or approving the construction means, methods, techniques, sequences or procedures. The Owner's approval shall not relieve the Contractor of any obligations. Unless expressly addressed in a Modification, the Owner's approval of a schedule shall not change the Contract Time.

§ 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.

§ 3.12.5.1 The fire sprinkler shop drawings shall be prepared by a licensed fire sprinkler contractor and shall accurately reflect actual conditions affecting the required layout of the fire sprinkler system. The fire sprinkler contractor shall certify the accuracy of his shop drawings prior to submitting them for review and approval. The fire sprinkler shop drawings shall be reviewed and approved by the Architect's engineer of record who, upon approving the sprinkler shop drawings will submit them to the State Fire Marshal for review and approval. A copy of the shop drawings will also be sent to OSE for information. The Architect's engineer of record will submit a copy of the State Fire Marshal's approval letter to the Contractor, Architect, and OSE. Unless authorized in writing by OSE, neither the Contractor nor subcontractor at any tier shall submit the fire sprinkler shop drawings directly to the State Fire Marshal for approval.

§ 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, who shall comply with reasonable requirements of the Owner regarding qualifications and insurance and 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

§ 3.13.1 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.

§ 3.13.2 Protection of construction materials and equipment stored at the Project site from weather, theft, vandalism, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall perform the work in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials, and equipment likely to cause hazardous conditions.

§ 3.13.3 The Contractor and any entity for which the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner.

§ 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) including loss of use resulting therefrom, but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Architect is that person or entity 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. Any reference in the Contract Documents to the Architect taking action or rendering a decision with a "reasonable time" is understood to mean no more than fourteen days, unless otherwise specified in the Contract Documents or otherwise agreed to by the parties.

§ 4.2.2 The Architect will visit the site as necessary to fulfill its obligation to the Owner for inspection services, if any, and, at a minimum, to assure conformance with the Architect's design as shown in the Contract Documents and to observe the progress and quality of the various components of the Contractor's Work, and to determine 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 informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) 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 Work completed and correlated with 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, in the first instance, interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. Upon receipt of such request, the Architect will promptly provide the non-requesting party with a copy of the request. The Architect's response to such requests will be made in writing 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, and will not show partiality to either. Except in the case of interpretations resulting in omissions, defects, or errors in the Instruments of Service or perpetuating omissions, defects, or errors in the Instruments of Service, the Architect will not be liable for results of interpretations or decisions rendered in good faith. If either party disputes the Architect's interpretation or decision, that party may proceed as provided in Article 15. The Architect's interpretations and decisions may be, but need not be, accorded any deference in any review conducted pursuant to law or the Contract Documents.

§ 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 so as to avoid delay to the construction of the Project. The Architect's response to such requests will be made in writing with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information. Any response to a request for information must be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. Unless issued pursuant to a Modification, supplemental Drawings or Specifications will not involve an adjustment to the Contract Sum or Contract Time.

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, within fourteen days after posting of the Notice of Intent to Award the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (excluding Listed Subcontractors but including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Owner may reply within 14 days to the Contractor in writing stating whether the Owner has reasonable objection to any such proposed person or entity. Failure of the Owner 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 has made reasonable and timely objection. The Owner shall not direct the Contractor to contract with any specific individual or entity for supplies or services unless such supplies and services are necessary for completion of the Work and the specified individual or entity is the only source of such supply or services.

§ 5.2.3 If the Owner has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner has no reasonable objection. If the proposed but rejected Subcontractor was

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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 makes reasonable objection to such substitution. The Contractor's request for substitution must be made to the Owner in writing accompanied by supporting information.

§ 5.2.5 A Subcontractor identified in the Contractor's Bid in response the specialty subcontractor listing requirements of Section 7 of the Bid Form (SE-330) may only be substituted in accordance with and as permitted by the provisions of Title 11, Chapter 35, Section 3021 of the South Carolina Code of Laws, as amended. A proposed substitute for a Listed Subcontractor shall be subject to the Owner's approval as set forth in Section 5.2.3.

§ 5.2.6 The Iran Divestment Act List is a list published by the State Fiscal Accountability Authority pursuant to Section 11-57-310 that identifies persons engaged in investment activities in Iran. Currently, the list is available at the following URL: <http://procurement.sc.gov/PS/PS-iran-divestment.phtml>(.) Consistent with Section 11-57-330(B), the Contractor shall not contract with any person to perform a part of the Work, if, at the time you enter into the subcontract, that person is on the then-current version of the Iran Divestment Act List.

§ 5.3 SUBCONTRACTUAL RELATIONS

§ 5.3.1 By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, 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 herein or in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.2 Without limitation on the generality of Section 5.3.1, each Subcontract agreement and each Sub-subcontract agreement shall include, and shall be deemed to include, the following Sections of these General Conditions: 3.2, 3.5, 3.18, 5.3, 5.4, 6.2.2, 7.3.3, 7.5, 7.6, 13.1, 13.12, 14.3, 14.4, and 15.1.6.

§ 5.3.3 Each Subcontract Agreement and each Sub-subcontract agreement shall exclude, and shall be deemed to exclude, Sections 13.2 and 13.6 and all of Article 15, except Section 15.1.6, of these General Conditions. In the place of these excluded sections of the General Conditions, each Subcontract Agreement and each Sub-subcontract may include Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of AIA Document A201-2007, Conditions of the Contract, as originally issued by the American Institute of Architects.

§ 5.3.4 The Contractor shall assure the Owner that all agreements between the Contractor and its Subcontractor incorporate the provisions of Subparagraph 5.3.1 as necessary to preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the work to be performed by Subcontractors so that the subcontracting thereof will not prejudice such rights. The Contractor's assurance shall be in the form of an affidavit or in such other form as the Owner may approve. Upon request, the Contractor shall provide the Owner or Architect with copies of any or all subcontracts or purchase orders.

§ 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.

§ 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.

§ 5.4.4 Each subcontract shall specifically provide that the Owner shall only be responsible to the subcontractor for those obligations of the Contractor that accrue subsequent to the Owner's exercise of any rights under this conditional assignment.

§ 5.4.5 Each subcontract shall specifically provide that the Subcontractor agrees to perform portions of the Work assigned to the Owner in accordance with the Contract Documents.

§ 5.4.6 Nothing in this Section 5.4 shall act to reduce or discharge the Contractor's payment bond surety's obligations to claimants for claims arising prior to the Owner's exercise of any rights under this conditional assignment.

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 Reserved.

§ 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. If the amount of a Modification exceeds the limits of the Owner's Construction Change Order Certification (reference Section 9.1.7.2 of the Agreement), then the Owner's agreement is not effective, and Work may not proceed, until approved in writing by the Office of State Engineer.

§ 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 (using Form SE-380 "Construction Change Order") 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.

§ 7.2.2 If a Change Order provides for an adjustment to the Contract Sum, the adjustment must be calculated in accordance with Section 7.3.3.

§ 7.2.3 At the Owner's request, the Contractor shall prepare a proposal to perform the work of a proposed Change Order setting forth the amount of the proposed adjustment, if any, in the Contract Sum; and the extent of the proposed adjustment, if any, in the Contract Time. Any proposed adjustment in the Contract sum shall be prepared in accordance with Section 7.2.2. The Owner's request shall include any revisions to the Drawings or Specifications necessary to define any changes in the Work. Within fifteen days of receiving the request, the Contractor shall submit the proposal to the Owner and Architect along with all documentation required by Section 7.6.

§ 7.2.4 If the Contractor requests a Change Order, the request shall set forth the proposed change in the Work and shall be prepared in accordance with Section 7.2.3. If the Contractor requests a change to the Work that involves a revision to either the Drawings or Specifications, the Contractor shall reimburse the Owner for any expenditure associated with the Architects' review of the proposed revisions, except to the extent the revisions are accepted by

execution of a Change Order.

§ 7.2.5 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, any adjustments to the Contract Sum or 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 PRICE ADJUSTMENTS

§ 7.3.3.1 If any Modification, including a Construction Change Directive, provides for an adjustment to the Contract Sum, the adjustment shall be based on whichever of the following methods is the most valid approximation of the actual cost to the contractor, with overhead and profit as allowed by Section 7.5:

- .1 Mutual acceptance of a lump sum;
- .2 Unit prices stated in the Contract Documents, except as provided in Section 7.3.4, or subsequently agreed upon;
- .3 Cost attributable to the events or situations under applicable clauses with adjustment of profits or fee, all as specified in the contract, or subsequently agreed upon by the parties, or by some other method as the parties may agree; or
- .4 As provided in Section 7.3.7.

§ 7.3.3.2 Consistent with Section 7.6, costs must be properly itemized and supported by substantiating data sufficient to permit evaluation before commencement of the pertinent performance or as soon after that as practicable. All costs incurred by the Contractor must be justifiably compared with prevailing industry standards. Except as provided in Section 7.5, all adjustments to the Contract Price shall be limited to job specific costs and shall not include indirect costs, overhead, home office overhead, or profit.

§ 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 make an initial determination, consistent with Section 7.3.3, of 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 Section 7.5. In such case, and also under Section 7.3.3.1.3, 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;

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- .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.

§ 7.3.8 Using the percentages stated in Section 7.5, any adjustment to the Contract Sum for deleted work shall include any overhead and profit attributable to the cost for the deleted Work.

§ 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.

§ 7.5 AGREED OVERHEAD AND PROFIT RATES

§ 7.5.1 For any adjustment to the Contract Sum for which overhead and profit may be recovered, other than those made pursuant to Unit Prices stated in the Contract Documents, the Contractor agrees to charge and accept, as full payment for overhead and profit, the following percentages of costs attributable to the change in the Work. The percentages cited below shall be considered to include all indirect costs including, but not limited to: field and office managers, supervisors and assistants, incidental job burdens, small tools, and general overhead allocations. The allowable percentages for overhead and profit are as follows:

- .1 To the Contractor for work performed by the Contractor's own forces, 17% of the Contractor's actual costs.
- .2 To each Subcontractor for work performed by the Subcontractor's own forces, 17% of the subcontractor's actual costs.
- .3 To the Contractor for work performed by a subcontractor, 10% of the subcontractor's actual costs (not including the subcontractor's overhead and profit).

§ 7.6 PRICING DATA AND AUDIT

§ 7.6.1 Cost or Pricing Data

Upon request of the Owner or Architect, Contractor shall submit cost or pricing data prior to execution of a Modification which exceeds \$500,000. Contractor shall certify that, to the best of its knowledge and belief, the cost or pricing data submitted is accurate, complete, and current as of a mutually determined specified date prior to the date of pricing the Modification. Contractor's price, including profit, shall be adjusted to exclude any significant sums by which such price was increased because Contractor furnished cost or pricing data that was inaccurate, incomplete, or not current as of the date specified by the parties. Notwithstanding Subparagraph 9.10.4, such adjustments may be made after final payment to the Contractor.

§ 7.6.2 Cost or pricing data means all facts that, as of the date specified by the parties, prudent buyers and sellers would reasonably expect to affect price negotiations significantly. Cost or pricing data are factual, not judgmental; and are verifiable. While they do not indicate the accuracy of the prospective contractor's judgment about estimated future costs or projections, they do include the data forming the basis for that judgment. Cost or pricing data are

more than historical accounting data; they are all the facts that can be reasonably expected to contribute to the soundness of estimates of future costs and to the validity of determinations of costs already incurred.

§ 7.6.3 Records Retention

As used in Section 7.6, the term "records" means any books or records that relate to cost or pricing data that Contractor is required to submit pursuant to Section 7.6.1. Contractor shall maintain records for three years from the date of final payment, or longer if requested by the chief procurement officer. The Owner may audit Contractor's records at reasonable times and places.

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 commence operations on the site or elsewhere prior to the effective date of surety bonds and 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 surety bonds or 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 control of the Contractor and any subcontractor at any tier; or by delay authorized by the Owner pending dispute resolution; or by other causes that the Architect determines may justify delay, then to the extent such delay will prevent the Contractor from achieving Substantial Completion within the Contract Time and provided the delay (1) is not caused by the fault or negligence of the Contractor or a subcontractor at any tier and (2) is not due to unusual delay in the delivery of supplies, machinery, equipment, or services when such supplies, machinery, equipment, or services were obtainable from other sources in sufficient time for the Contractor to meet the required delivery, 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. All changes to the Contract Sum shall be adjusted in accordance with Section 7.3.3.

§ 9.2 SCHEDULE OF VALUES

§ 9.2.1 The Contractor shall submit to the Architect, within ten days of full execution of the Agreement, 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. As requested by the Architect, the Contractor and each Subcontractor shall prepare a trade payment breakdown for the Work for which each is responsible, such breakdown being submitted on a uniform standardized format approved by the Architect and Owner. The breakdown shall be divided in detail, using convenient units, sufficient to accurately determine the value of completed Work during the course of the Project. The Contractor shall update the schedule of values as required by either the Architect or Owner as necessary to reflect:

- .1 the description of Work (listing labor and material separately);
- .2 the total value;
- .3 the percent and value of the Work completed to date;
- .4 the percent and value of previous amounts billed; and
- .5 the current percent completed and amount billed.

§ 9.2.2 Any schedule of values or trade breakdown that fails to include sufficient detail, is unbalanced, or exhibits "front-loading" of the value of the Work shall be rejected. If a schedule of values or trade breakdown is used as the basis for payment and later determined to be inaccurate, sufficient funds shall be withheld from future Applications for Payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Work.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 Monthly, 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 and any other adjustments provided in Section 5 of the Agreement. If required by the Owner or Architect, the Application for Payment shall be accompanied by a current construction schedule.

§ 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 provided such materials or equipment will be subsequently incorporated in the Work. 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. The Contractor shall 1) protect such materials from diversion, vandalism, theft, destruction, and damage, 2) mark such materials specifically for use on the Project, and 3) segregate such materials from other materials at the storage facility. The Architect and the Owner shall have the right to make inspections of the storage areas at any time.

§ 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 in both the Application for Payment and, if required to be submitted by the Contractor, the accompanying current construction schedule 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, or (3) 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 shall 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. The Architect shall withhold a Certificate of Payment if the Application for Payment is not accompanied by the current construction schedule required by Section 3.10.1. 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 Pursuant to Chapter 6 of Title 29 of the South Carolina Code of Laws, as amended, 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 to the Owner, 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 time established in the Contract Documents the amount certified by the Architect or awarded by final dispute resolution order, 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, in accordance with the provisions of Section 7.3.3, 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 and when all required occupancy permits, if any, have been issued and copies have been delivered to the Owner.

§ 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 written 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, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, to determine whether the Work or designated portion thereof is substantially complete. The Contractor shall furnish access for the inspection and testing as provided in this Contract. The inspection shall include a demonstration by the Contractor that all equipment, systems and operable components of the Work function properly and in accordance with the Contract Documents. 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. If more than one Substantial Completion inspection is required, the Contractor shall reimburse the Owner for all costs of re-inspections or, at the Owner's option, the costs may be deducted from payments due to the Contractor.

§ 9.8.3.1 If the Architect and Owner concur in the Contractor's assessment that the Work or a portion of the Work is safe to occupy, the Owner and Contractor may arrange for a Certificate of Occupancy Inspection by OSE. The Owner, Architect, and Contractor shall be present at OSE's inspection. Upon verifying that the Work or a portion of the Work is substantially complete and safe to occupy, OSE will issue, as appropriate, a Full or Partial Certificate of Occupancy.

§ 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, 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 Unless the parties agree otherwise in the Certificate of Substantial Completion, the Contractor shall achieve Final Completion no later than thirty days after Substantial Completion. 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, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, 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. If more than one Final Completion inspection is required, the Contractor shall reimburse the Owner for all costs of re-inspections or, at the Owner's option, the costs may be deducted from payments due to the Contractor. If the Contractor does not achieve final completion within thirty days after Substantial Completion or the timeframe agreed to by the parties in the Certificate of Substantial Completion, whichever is greater, the Contractor shall be responsible for any additional Architectural fees resulting from the delay.

§ 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 (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, (6) required Training Manuals, (7) equipment Operations and Maintenance Manuals, (8) any certificates of testing, inspection or approval required by the Contract Documents and not previously provided (9) all warranties and guarantees required under or pursuant to the Contract Documents, and (10) one copy of the Documents required by Section 3.11.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is delayed 60 days 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 specific claims in stated amounts that have been previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.10.6 If OSE has not previously issued a Certificate of Occupancy for the entire Project, the Parties shall arrange for a representative of OSE to participate in the Final Completion Inspection. Representatives of the State Fire Marshal's Office and other authorities having jurisdiction may be present at the Final Completion Inspection or otherwise inspect the completed Work and advise the Owner whether the Work meets their respective requirements for the Project.

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 If the Contractor encounters a hazardous material or substance which was not discoverable as provided in Section 3.2.1 and not required by the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons or serious loss to real or personal property resulting from such material or substance 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. Hazardous materials or substances are those hazardous, toxic, or radioactive materials or substances subject to regulations by applicable governmental authorities having jurisdiction, such as, but not limited to, the S.C. Department of Health and Environmental Control, the U.S. Environmental Protection Agency, and the U.S. Nuclear Regulatory Commission.

§ 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. In the absence of agreement, the Architect will make an interim determination regarding any delay or impact on the Contractor's additional costs. 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. Any adjustment in the Contract Sum shall be determined in accordance with Section 7.3.3.

§ 10.3.3 The Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (a) the Owner causes remedial work to be performed that results in the absence of hazardous materials or substances; (b) the Owner and the Contractor, by written agreement, decide to resume performance of the Work; or (c) the Work may safely and lawfully proceed, as determined by an appropriate governmental authority or as evidenced by a written report to both the Owner and the Contractor, which is prepared by an environmental engineer reasonably satisfactory to both the Owner and the Contractor.

§ 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 In addition to its obligations under Section 3.18, 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 Reserved.

§ 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. The Contractor shall immediately give the Architect notice of the emergency. This initial notice may be oral followed within five days by a written notice setting forth the nature and scope of the emergency. Within fourteen days of the start of the emergency, the Contractor shall give the Architect a written estimate of the cost and probable effect of delay on the progress of the Work.

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 below or required by law, whichever coverage is greater. Coverages, shall be written on an occurrence basis and 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.

- .1 COMMERCIAL GENERAL LIABILITY:
 - (a) General Aggregate (per project) \$1,000,000
 - (b) Products/Completed Operations \$1,000,000
 - (c) Personal and Advertising Injury \$1,000,000
 - (d) Each Occurrence \$1,000,000
 - (e) Damage to Rented Premises (ea occurrence) \$50,000
 - (f) Medical Expense (Any one person) \$5,000
- .2 BUSINESS AUTO LIABILITY (including All Owned, Non-owned, and Hired Vehicles):
 - (a) Combined Single Limit \$1,000,000
- .3 WORKER'S COMPENSATION:
 - (a) State Statutory
 - (b) Employers Liability \$100,000 per Acc.
 \$500,000 Disease, Policy Limit
 \$100,000 Disease, Each Employee

In lieu of separate insurance policies for Commercial General Liability, Business Auto Liability, and Employers Liability, the Contractor may provide an umbrella policy meeting or exceeding all coverage requirements set forth in this Section 11.1.2. The umbrella policy limits shall not be less than \$3,000,000.

§ 11.1.3 Prior to commencement of the Work, and thereafter upon replacement of each required policy of insurance, the Contractor shall provide to the Owner a written endorsement to the Contractor's general liability insurance policy that:

- .1 names the Owner as an additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations;
- .2 provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall have effect unless all additional insureds have been given at least ten (10) days prior written notice of cancellation for non-payment of premiums and thirty (30) days prior written notice of cancellation for any other reason; and
- .3 provides that the Contractor's liability insurance policy shall be primary, with any liability insurance of the Owner as secondary and noncontributory.

Prior to commencement of the Work, and thereafter upon renewal or replacement of each required policy of insurance, the Contractor shall provide to the Owner a signed, original certificate of liability insurance (ACORD 25). Consistent with this Section 11.1, the certificate shall identify the types of insurance, state the limits of liability for each type of coverage, name the Owner a Consultants as Certificate Holder, provide that the general aggregate limit applies per project, and provide that coverage is written on an occurrence basis. Both the certificates and the endorsements must be received directly from either the Contractor's insurance agent or the insurance company. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, naming the Owner as an additional insured for claims made under the Contractor's completed operations, and otherwise meeting the above requirements, 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 A failure by the Owner to either (i) demand a certificate of insurance or written endorsement required by Section 11.1, or (ii) reject a certificate or endorsement on the grounds that it fails to comply with Section 11.1, shall not be considered a waiver of Contractor's obligations to obtain the required insurance.

§ 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 in the Contract Documents, the Contractor 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. 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 Reserved.

§ 11.3.1.3 Reserved.

§ 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 Contractor 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. To the extent any losses are covered and paid for by such insurance, 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 Owner 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 Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.

§ 11.3.5 Reserved.

§ 11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner 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 Owner.

§ 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 the property insurance provided by the Contractor pursuant to this Section 11.3 covers and pays for the damage, except such rights as they have to proceeds of such insurance held by the Contractor 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 Contractor's property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor 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 Contractor as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach. 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.

§ 11.3.10 The Contractor 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 Contractor's exercise of this power; if such objection is made, the dispute shall be resolved in the manner provided in the contract between the parties in dispute as the method of binding dispute resolution. The Contractor as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with a final order or determination issued by the appropriate authority having jurisdiction over the dispute.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 Before commencing any services hereunder, the Contractor shall provide the Owner with Performance and Payment Bonds, each in an amount not less than the Contract Price set forth in Article 4 of the Agreement. The Surety shall have, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty". In addition, the Surety shall have a minimum "Best Financial Strength Category" of "Class V", and in no case less than five (5) times the contract amount. The Performance Bond shall be written on Form SE-355, "Performance Bond" and the Payment Bond shall be written on Form SE-357, "Labor and Material Payment Bond", and both shall be made payable to the Owner.

§ 11.4.2 The Performance and Labor and Material Payment Bonds shall:

- .1 be issued by a surety company licensed to do business in South Carolina;
- .2 be accompanied by a current power of attorney and certified by the attorney-in-fact who executes the bond on the behalf of the surety company; and

- 3 remain in effect for a period not less than one (1) year following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer.

§ 11.4.3 Any bonds required by this Contract shall meet the requirements of the South Carolina Code of Laws and Regulations, as amended.

§ 11.4.4 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 requirements specifically expressed in the Contract Documents, including inspections of work-in-progress required by all authorities having jurisdiction over the Project, it must, upon demand of the Architect or authority having jurisdiction, be uncovered for observation 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. 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 unless otherwise provided in the Contract Documents.

§ 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. If, prior to the date of Substantial Completion, the Contractor, a Subcontractor, or anyone for whom either is responsible, uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

§ 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, any dispute, claim, or controversy relating to the Contract, and all the rights and obligations of the parties shall, in all respects, be interpreted, construed, enforced and governed by and under the laws of the State of South Carolina, except its choice of law rules.

§ 13.2 SUCCESSORS AND ASSIGNS

The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole, or in part, without written consent of the other and then only in accordance with and as permitted by Regulation 19-445.2180 of the South Carolina Code of Regulations, as amended. 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.

§ 13.3 WRITTEN NOTICE

Unless otherwise permitted herein, all notices contemplated by the Contract Documents shall be in writing and shall be deemed given:

- .1 upon actual delivery, if delivery is by hand;
- .2 upon receipt by the transmitting party of confirmation or reply, if delivery is by electronic mail, facsimile, telex or telegram;
- .3 upon receipt, if delivery is by the United States mail.

Notice to Contractor shall be to the address provided in Section 8.4.2 of the Agreement. Notice to Owner shall be to the address provided in Section 8.3.2 of the Agreement. Either party may designate a different address for notice by giving notice in accordance with this paragraph.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Unless expressly provided otherwise, 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.

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§ 13.4.3 Notwithstanding Section 9.10.4, the rights and obligations which, by their nature, would continue beyond the termination, cancellation, rejection, or expiration of this contract shall survive such termination, cancellation, rejection, or expiration, including, but not limited to, the rights and obligations created by the following clauses:

- 1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service;
- 3.5 Warranty
- 3.17 Royalties, Patents and Copyrights
- 3.18 Indemnification
- 7.6 Cost or Pricing Data
- 11.1 Contractor's Liability Insurance
- 11.4 Performance and Payment Bond
- 15.1.6 Claims for Listed Damages
- 15.1.7 Waiver of Claims Against the Architect
- 15.6 Dispute Resolution
- 15.6.5 Service of Process

§ 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 to the Contractor and unpaid under the Contract Documents shall bear interest only if and to the extent allowed by Title 29, Chapter 6, Article 1 of the South Carolina Code of Laws. Amounts due to the Owner shall bear interest at the rate of one percent a month or a pro rata fraction thereof on the unpaid balance as may be due.

§ 13.7 Reserved

§ 13.8 PROCUREMENT OF MATERIALS BY OWNER

The Contractor accepts assignment of all purchase orders and other agreements for procurement of materials and equipment by the Owner that are identified as part of the Contract Documents. The Contractor shall, upon delivery, be responsible for the storage, protection, proper installation, and preservation of such Owner purchased items, if any, as if the Contractor were the original purchaser. The Contract Sum includes, without limitation, all costs and expenses in connection with delivery, storage, insurance, installation, and testing of items covered in any assigned purchase orders or agreements. Unless the Contract Documents specifically provide otherwise, all Contractor warranty of workmanship and correction of the Work obligations under the Contract Documents shall apply to the Contractor's installation of and modifications to any Owner purchased items,.

§ 13.9 INTERPRETATION OF BUILDING CODES

As required by Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, OSE shall determine the enforcement and interpretation of all building codes and referenced standards on state buildings. The Contractor shall refer any questions, comments, or directives from local officials to the Owner and OSE for resolution.

§ 13.10 MINORITY BUSINESS ENTERPRISES

Contractor shall notify Owner of each Minority Business Enterprise (MBE) providing labor, materials, equipment, or supplies to the Project under a contract with the Contractor. Contractor's notification shall be via the first monthly status report submitted to the Owner after execution of the contract with the MBE. For each such MBE, the Contractor shall provide the MBE's name, address, and telephone number, the nature of the work to be performed or materials or equipment to be supplied by the MBE, whether the MBE is certified by the South Carolina Office of Small and Minority Business Assistance, and the value of the contract.

§ 13.11 SEVERABILITY

If any provision or any part of a provision of the Contract Documents shall be finally determined to be superseded, invalid, illegal, or otherwise unenforceable pursuant to any applicable Legal Requirements, such determination shall not impair or otherwise affect the validity, legality, or enforceability of the remaining provision or parts of the provision of the Contract Documents, which shall remain in full force and effect as if the unenforceable provision or part were deleted.

§ 13.12 ILLEGAL IMMIGRATION

Contractor certifies and agrees that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws and agrees to provide to the State upon request any documentation required to establish either: (a) that Title 8, Chapter 14 is inapplicable both to Contractor and its subcontractors or sub-subcontractors; or (b) that Contractor and its subcontractors or sub-subcontractors are in compliance with Title 8, Chapter 14. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." Contractor agrees to include in any contracts with its subcontractors language requiring its subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14. (An overview is available at www.procurement.sc.gov)

§ 13.13 SETOFF

The Owner shall have all of its common law, equitable, and statutory rights of set-off.

§ 13.14 DRUG-FREE WORKPLACE

The Contractor certifies to the Owner that Contractor will provide a Drug-Free Workplace, as required by Title 44, Chapter 107 of the South Carolina Code of Laws, as amended.

§ 13.15 FALSE CLAIMS

According to the S.C. Code of Laws § 16-13-240, "a person who by false pretense or representation obtains the signature of a person to a written instrument or obtains from another person any chattel, money, valuable security, or other property, real or personal, with intent to cheat and defraud a person of that property is guilty" of a crime.

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§ 13.16 NON-INDEMNIFICATION

Any term or condition is void to the extent it requires the State to indemnify anyone. It is unlawful for a person charged with disbursements of state funds appropriated by the General Assembly to exceed the amounts and purposes stated in the appropriations. (§ 11-9-20) It is unlawful for an authorized public officer to enter into a contract for a purpose in which the sum is in excess of the amount appropriated for that purpose. It is unlawful for an authorized public officer to divert or appropriate the funds arising from any tax levied and collected for any one fiscal year to the payment of an indebtedness contracted or incurred for a previous year. (§ 11-1-40)

§ 13.17 OPEN TRADE (JUN 2015)

During the contract term, including any renewals or extensions, Contractor will not engage in the boycott of a person or an entity based in or doing business with a jurisdiction with whom South Carolina can enjoy open trade, as defined in SC Code Section 11-35-5300. [07-7A053-1]

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 45 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 substantially all Work to be stopped; or
- .2 An act of government, such as a declaration of national emergency that requires substantially 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 and the Contractor has stopped work in accordance with Section 9.7

§ 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. Any adjustment to the Contract Sum pursuant to this Section shall be made in accordance with the requirements of Article 7.

§ 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 persistently 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, or otherwise fails to prosecute the Work, or any separable part of the Work, with the diligence, resources and skill that will ensure its completion within the time specified in the Contract Documents, including any authorized adjustments;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the Contract Documents and 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 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 Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.2.5 If, after termination for cause, it is determined that the Owner lacked justification to terminate under Section 14.2.1, or that the Contractor's default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Owner under Section 14.4.

§ 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. Any adjustment to the Contract Sum made pursuant to this section shall be made in accordance with the requirements of Article 7.3.3. 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 in whole or in part for the Owner's convenience and without cause. The Owner shall give written notice of the termination to the Contractor specifying the part of the Contract terminated and when termination becomes effective.

§ 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;
- .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; and
- .4 complete the performance of the Work not terminated, if any.

§ 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, and any other adjustments otherwise allowed by the Contract. Any adjustment to the Contract Sum made pursuant to this Section 14.4 shall be made in accordance with the requirements of Article 7.3.3.

§ 14.4.4 Contractor's failure to include an appropriate termination for convenience clause in any subcontract shall not (i) affect the Owner's right to require the termination of a subcontract, or (ii) increase the obligation of the Owner beyond what it would have been if the subcontract had contained an appropriate clause.

§ 14.4.5 Upon written consent of the Contractor, the Owner may reinstate the terminated portion of this Contract in whole or in part by amending the notice of termination if it has been determined that:

- .1 the termination was due to withdrawal of funding by the General Assembly, Governor, or State Fiscal Accountability Authority or the need to divert project funds to respond to an emergency as defined by Regulation 19-445.2110(B) of the South Carolina Code of Regulations, as amended;
- .2 funding for the reinstated portion of the work has been restored;
- .3 circumstances clearly indicate a requirement for the terminated work; and
- .4 reinstatement of the terminated work is advantageous to the Owner.

§ 14.5 CANCELLATION AFTER AWARD BUT PRIOR TO PERFORMANCE

Pursuant to Title 11, Chapter 35 and Regulation 19-445.2085 of the South Carolina Code of Laws and Regulations, as amended, this contract may be canceled after award but prior to performance.

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. A voucher, invoice, payment application or other routine request for payment that is not in dispute when submitted is not a Claim under this definition. 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 Architect. Such notice shall include sufficient information to advise the Architect and other party of the circumstances giving rise to the claim, the specific contractual adjustment or relief requested and the basis of such request. Claims by either party arising prior to the date final payment is due 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 except as stated for adverse weather days in Section 15.1.5.2. By failing to give written notice of a Claim within the time required by this Section, a party expressly waives its claim.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, including any administrative review allowed under Section 15.6, 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 issue Certificates for Payment in accordance with the initial decisions and determinations of the Architect.

§ 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. Claims for an increase in the Contract Time shall be based on one additional calendar day for each full calendar day that the Contractor is prevented from working.

Init.

§ 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.

- .1 Claims for adverse weather shall be based on actual weather conditions at the job site or other place of performance of the Work, as documented in the Contractor's job site log.
- .2 For the purpose of this Contract, a total of five (5) days per calendar month (non-cumulative) shall be anticipated as "adverse weather" at the job site, and such time will not be considered justification for an extension of time. If, in any month, adverse weather develops beyond the five (5) days, the Contractor shall be allowed to claim additional days to compensate for the excess weather delays only to the extent of the impact on the approved construction schedule and days the contractor was already scheduled to work. The remedy for this condition is for an extension of time only and is exclusive of all other rights and remedies available under the Contract Documents or imposed or available by law.
- .3 The Contractor shall submit monthly with their pay application all claims for adverse weather conditions that occurred during the previous month. The Architect shall review each monthly submittal in accordance with Section 15.5 and inform the Contractor and the Owner promptly of its evaluation. Approved days shall be included in the next Change Order issued by the Architect. Adverse weather conditions not claimed within the time limits of this Subparagraph shall be considered to be waived by the Contractor. Claims will not be allowed for adverse weather days that occur after the scheduled (original or adjusted) date of Substantial Completion.

§ 15.1.6 CLAIMS FOR LISTED DAMAGES

Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor and Owner waive Claims against each other for listed damages arising out of or relating to this Contract.

§ 15.1.6.1 For the Owner, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) costs suffered by a third party unable to commence work, (vi) attorney's fees, (vii) any interest, except to the extent allowed by Section 13.6 (Interest), (viii) lost revenue and profit for lost use of the property, (ix) costs resulting from lost productivity or efficiency.

§ 15.1.6.2 For the Contractor, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest, except to the extent allowed by Section 13.6 (Interest); (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. Without limitation, this mutual waiver is applicable to all damages due to either party's termination in accordance with Article 14.

§ 15.1.6.3 Nothing contained in this Section shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

§ 15.1.7 WAIVER OF CLAIMS AGAINST THE ARCHITECT

Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor waives all claims against the Architect and any other design professionals who provide design and/or project management services to the Owner, either directly or as independent contractors or subcontractors to the Architect, for listed damages arising out of or relating to this Contract. The listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest; (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waive as against the Owner. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

§ 15.2 Reserved.

§ 15.3 Reserved.

§ 15.4 Reserved.

§ 15.5 CLAIM AND DISPUTES - DUTY OF COOPERATION, NOTICE, AND ARCHITECTS INITIAL DECISION

§ 15.5.1 Contractor and Owner are fully committed to working with each other throughout the Project to avoid or minimize claims. To further this goal, Contractor and Owner agree to communicate regularly with each other and the Architect at all times notifying one another as soon as reasonably possible of any issue that if not addressed may cause loss, delay, and/or disruption of the Work. If claims do arise, Contractor and Owner each commit to resolving such claims in an amicable, professional, and expeditious manner to avoid unnecessary losses, delays, and disruptions to the Work.

§ 15.5.2 Claims shall first be referred to the Architect for initial decision. An initial decision shall be required as a condition precedent to resolution pursuant to Section 15.6 of any Claim arising prior to the date of final payment, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered, or after all the Architect's requests for additional supporting data have been answered, whichever is later. The Architect will not address claims between the Contractor and persons or entities other than the Owner.

§ 15.5.3 The Architect will review Claims and within ten days of the receipt of a Claim (1) request additional supporting data from the claimant or a response with supporting data from the other party or (2) render an initial decision in accordance with Section 15.5.5.

§ 15.5.4 If the Architect 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 Architect when the response or supporting data will be furnished or (3) advise the Architect that all supporting data has already been provided. Upon receipt of the response or supporting data, the Architect will render an initial decision in accordance with Section 15.5.5.

§ 15.5.5 The Architect will render an initial decision in writing; (1) stating the reasons therefor; and (2) notifying the parties of any change in the Contract Sum or Contract Time or both. The Architect will deliver the initial decision to the parties within two weeks of receipt of any response or supporting data requested pursuant to Section 16.4 or within such longer period as may be mutually agreeable to the parties. If the parties accept the initial decision, the Architect shall prepare a Change Order with appropriate supporting documentation for the review and approval of the parties and the Office of State Engineer. If either the Contractor, Owner, or both, disagree with the initial decision, the Contractor and Owner shall proceed with dispute resolution in accordance with the provisions of Section 15.6.

§ 15.5.6 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.

§ 15.6 DISPUTE RESOLUTION

§ 15.6.1 If a claim is not resolved pursuant to Section 15.5 to the satisfaction of either party, both parties shall attempt to resolve the dispute at the field level through discussions between Contractor's Representative and Owner's Representative. If a dispute cannot be resolved through Contractor's Representative and Owner's Representative, then the Contractor's Senior Representative and the Owner's Senior Representative, upon the request of either party, shall meet as soon as conveniently possible, but in no case later than twenty-one days after such a request is made, to attempt to resolve such dispute. Prior to any meetings between the Senior Representatives, the parties will exchange relevant information that will assist the parties in resolving their dispute. The meetings required by this Section are a condition precedent to resolution pursuant to Section 15.6.2.

§ 15.6.2 If after meeting in accordance with the provisions of Section 15.6.1, the Senior Representatives determine that the dispute cannot be resolved on terms satisfactory to both the Contractor and the Owner, then either party may submit the dispute by written request to South Carolina's Chief Procurement Officer for Construction (CPOC). Except as otherwise provided in Article 15, all claims, claims, or controversies relating to the Contract shall be resolved exclusively by the appropriate Chief Procurement Officer in accordance with Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws, or in the absence of jurisdiction, only in the Court of Common Pleas for, or in the absence of jurisdiction a federal court located in, Richland County, State of South Carolina. Contractor agrees

that any act by the State regarding the Contract is not a waiver of either the State's sovereign immunity or the State's immunity under the Eleventh Amendment of the United State's Constitution.

§ 15.6.3 If any party seeks resolution to a dispute pursuant to Section 15.6.2, the parties shall participate in non-binding mediation to resolve the claim. If the claim is governed by Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws as amended and the amount in controversy is \$100,000.00 or less, the CPOC shall appoint a mediator, otherwise, the mediation shall be conducted by an impartial mediator selected by mutual agreement of the parties. or if the parties cannot so agree, a mediator designated by the American Arbitration Association ("AAA") pursuant to its Construction Industry Mediation Rules. The mediation will be governed by and conducted pursuant to a mediation agreement negotiated by the parties or, if the parties cannot so agree, by procedures established by the mediator.

§ 15.6.4 Without relieving any party from the other requirements of Sections 15.5 and 15.6, either party may initiate proceedings in the appropriate forum prior to initiating or completing the procedures required by Sections 15.5 and 15.6 if such action is necessary to preserve a claim by avoiding the application of any applicable statutory period of limitation or repose.

§ 15.6.5 SERVICE OF PROCESS

Contractor consents that any papers, notices, or process necessary or proper for the initiation or continuation of any claims, claims, or controversies relating to the Contract; for any court action in connection therewith; or for the entry of judgment on any award made. may be served on Contractor by certified mail (return receipt requested) addressed to Contractor at the address provided for the Contractor's Senior Representative or by personal service or by any other manner that is permitted by law, in or outside South Carolina. Notice by certified mail is deemed duly given upon deposit in the United States mail.

ARTICLE 16 PROJECT-SPECIFIC REQUIREMENTS AND INFORMATION

§ 16.1 INSPECTION REQUIREMENTS *(Indicate the inspection services required by the Contract)*

- Special Inspections are required and are not part of the Contract Sum. *(see section 01-400)*
- Building Inspections are required and are not part of the Contract Sum. *(see section 01-400)*

The inspections required for this Work are:

(Indicate which services are required and the provider)

- Civil:
- Structural:
- Mechanical: tbd
- Plumbing:
- Electrical: tbd
- Gas:
- Other *(list)*: Fire Resistant Joint Systems and Penetration Firestopping per IBC 1705.17.

Remarks:

§ 16.1.1 Contractor shall schedule and request inspections in an orderly and efficient manner and shall notify the Owner whenever the Contractor schedules an inspection in accordance with the requirements of Section 16.1. Contractor shall be responsible for the cost of inspections scheduled and conducted without the Owner's knowledge and for any increase in the cost of inspections resulting from the inefficient scheduling of inspections.

§ 16.2 List Cash Allowances, if any. *(Refer to attachments as needed, or enter NONE)*

See Specifications Section 012100 "Allowances"

Init.

§ 16.3 Requirements for Record Drawings, if any. *(Refer to attachments as needed, or enter NONE)*

See Specification Section 017839 "Project Record Documents"

§ 16.4 Requirements for Shop Drawings and other submittals, if any, including number, procedure for submission, list of materials to be submitted, etc. *(Refer to attachments as needed, or enter NONE)*

See Specifications Section 013300 "Submittal Procedures"

§ 16.5 Requirements for signage, on-site office or trailer, utilities, restrooms, etc.. in addition to the Contract, if any. *(Refer to attachments as needed, or enter NONE)*

See Specifications Section 015000 "Temporary Facilities and Controls"

§ 16.6 Requirements for Project Cleanup in addition to the Contract, if any. *(Refer to attachments as needed, or enter NONE)*

See Specifications Section "017700 "Closeout Procedures"

§ 16.7 List all attachments that modify these General Conditions. *(If none, enter NONE)*

16.7.1 Human Resources Management Policy, Tobacco-Free Campus, Policy 49

16.7.2 Minority and Women's Business Enterprise Program



HUMAN RESOURCES MANAGEMENT POLICY

TOBACCO-FREE CAMPUS

Policy 49

NOTE: THE LANGUAGE USED IN THIS DOCUMENT DOES NOT CREATE AN EMPLOYMENT CONTRACT BETWEEN THE EMPLOYEE AND THE MEDICAL UNIVERSITY OF SOUTH CAROLINA (MUSC). MUSC RESERVES THE RIGHT TO REVISE THE CONTENT OF THIS DOCUMENT, IN WHOLE OR IN PART. NO PROMISES OR ASSURANCES, WHETHER WRITTEN OR ORAL, WHICH ARE CONTRARY TO OR INCONSISTENT WITH THE TERMS OF THIS PARAGRAPH CREATE ANY CONTRACT OF EMPLOYMENT.

I. PURPOSE

MUSC is committed to promoting a healthy, tobacco-free environment for its employees, faculty, students, visitors and patients. The purpose of this policy is to provide a healthy environment, minimize the negative effects of passive smoke and tobacco use, maximize fire safety and promote wellness and good health habits within all MUSC facilities, including MUSC affiliates, and the surrounding campus.

II. POLICY

A. Covered Individuals

The provisions of this policy shall apply to all employees (including faculty and staff), patients, visitors, students, volunteers, contractors and vendors unless otherwise noted.

B. Use of Tobacco Products

The use of any tobacco product is prohibited in all buildings, grounds and spaces either leased or owned by the Medical University. The Human Resources Management **Policy No. 49, Tobacco-Free Campus**, includes, but is not limited to, offices, classrooms, laboratories, elevators, stairwells, restrooms, shuttle buses, shuttle bus stops, sidewalks, parking areas, meeting rooms, hallways, lobbies, and other common areas. The use of tobacco products in University owned, operated or leased vehicles is prohibited. Use of tobacco products is also prohibited in personal vehicles parked on MUSC property. The use of tobacco products is prohibited on all streets and sidewalks within the Medical District as defined by the City of Charleston ordinance (see map). MUSC also prohibits the use of tobacco products by staff on private properties adjacent to the Medical District without explicit approval from the property owner.

C. List of Tobacco Products

Tobacco products include, but are not limited to, cigarettes, cigars, pipes, chewing tobacco, e-cigarettes and other smokeless tobacco products.

III. INFORMATION AND PROCEDURE**A. Faculty/Staff/Volunteers**

1. Faculty, staff and volunteers are expected to comply with the Tobacco-Free Campus Policy and assist with sharing information about the policy.
2. New employees and volunteers will be informed of the Tobacco-Free Campus Policy during orientation.
3. Enforcement of the policy rests with the appropriate supervisory staff, deans, department heads and administrative officials.
4. When employees or volunteers observe violations of the policy, they should politely remind the offender of the policy and request that they dispose of tobacco materials.
5. If the employee or volunteer continues to violate the policy, the location and time of the violation should be reported to the appropriate supervisory staff, dean, department head or administrative official. Human Resources Employee Relations may also be contacted to report violations.
6. Violation patterns will be assessed and appropriate action initiated. Employees who are found to be in violation will be disciplined in accordance with the Human Resources Policy No. 45, **Disciplinary Action**. Action may

range from written reprimand to termination. Refer to specific guidelines as outlined by MUSC, MUHA and UMA.

B. Patients

1. Faculty, staff and clinical staff with patient care responsibilities are responsible for communicating and ensuring compliance with the Tobacco-Free Campus Policy.
2. Upon admission/check-in, patients will be verbally informed of the policy and a copy will be provided upon request.
3. Patients violating MUSC's policy will be asked to dispose of tobacco materials.
4. Tobacco replacement therapies, i.e. nicotine patch, nicotine gum, etc., may be prescribed by the patient's physician.

C. Visitors

1. Visitors will be informed of the policy and asked to comply while they are on campus.
2. Signage will be posted throughout MUSC's buildings and grounds; stating this facility is a tobacco-free campus.
3. All employees and volunteers are encouraged to assist with the education of visitors regarding the policy, using policy information cards, which will be made available.
4. Employees are expected to help enforce the policy with visitors by requesting that they dispose of tobacco materials and respect MUSC's healthcare mission and tobacco-free campus.
5. If a visitor is observed repeatedly violating the policy after being advised of the policy, staff should note the location and time of the violation and contact their respective manager, Department of Public Safety or Medical Center Safety and Security, or Human Resources.

D. Students

1. New students will be informed of the Tobacco-Free Campus Policy during orientation.
2. Enforcement of the policy rests with the respective Dean's office.
3. When students observe violations of the policy, they should remind their fellow students of the policy and ask them to dispose of the tobacco materials.
4. If the student continues to violate the policy, the location and time of the violation should be reported to the appropriate Dean's office.
5. Violation patterns will be assessed and appropriate action initiated.
6. Affiliation agreements will include the Tobacco-Free Campus Policy so that students from other schools will be advised of the policy.

E. Contractors/Vendors

1. A provision will be inserted in all contracts, e.g. construction and/or maintenance, to prohibit the employees of contractors/vendors from using tobacco materials on property owned or leased by MUSC.
2. Failure by the contractor/vendor or their employees to comply with the provisions of this policy could result in the termination of the contract.

IV. ENFORCEMENT

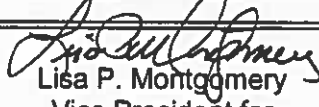
- A. The monitoring and enforcement of this policy is the responsibility of ALL MUSC/MUHA/UMA employees, students and volunteers. Each individual should consistently and politely bring any infraction of this policy to the attention of the person or persons observed violating the policy.
- B. The MUSC Department of Public Safety and Medical Center Safety and Security will assist in the enforcement of this policy by reporting violations to the appropriate manager or supervisor. Employees are also expected to assume leadership roles by adhering to the policy provisions and by reminding others who aren't in compliance of the policy provisions.
- C. MUSC will provide Tobacco-Free Campus Policy information cards to facilitate the education and enforcement of the policy.

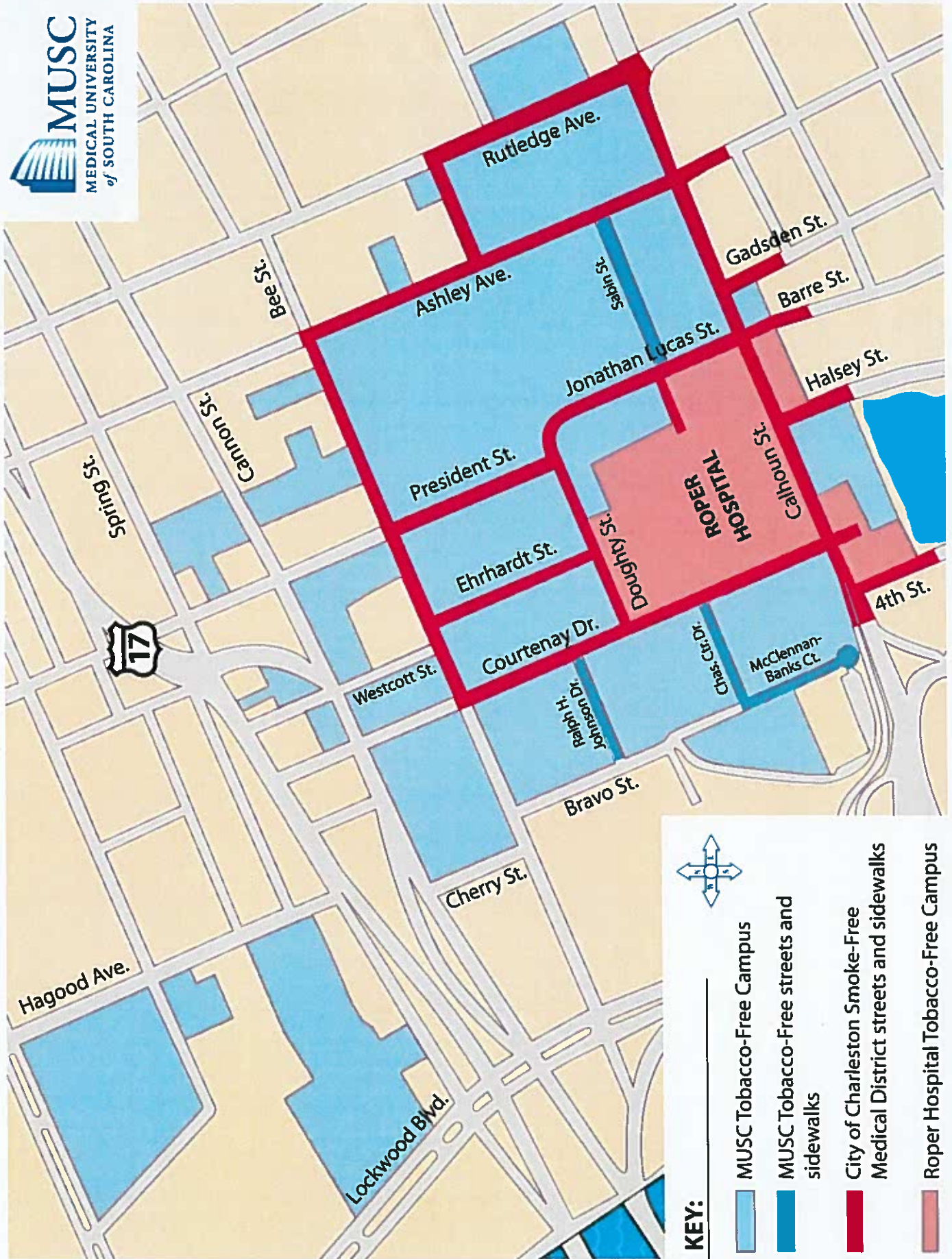
V. RESOURCES

MUSC will offer resources and support to tobacco users in abstaining from tobacco use on campus and in supporting users who desire to quit using tobacco. Smoking cessation classes and other tobacco education related resources or programs will be offered periodically for MUSC employees. Many of these programs are offered at little to no cost. Additional resources are outlined on the Tobacco-Free Campus website.

VI. EXCEPTIONS

Individuals enrolled in smoking research and/or treatment programs are permitted to smoke in designated smoking areas that are physically separated from care, treatment and service areas upon approval. If the Medical Center decides that patients may smoke in specific circumstances, it will designate smoking areas that are physically separated from care, treatment and service areas.

| Approved by: | Information Contact | Approved |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------|
|  Lisa P. Montgomery Vice President for Finance & Administration | Director of Human Resources Management | November, 2011 Effective March 1, 2012 |



KEY:

- MUSC Tobacco-Free Campus
- MUSC Tobacco-Free streets and sidewalks
- City of Charleston Smoke-Free Medical District streets and sidewalks
- Roper Hospital Tobacco-Free Campus

PROGRAM OBJECTIVES

1. MUSC/MUHA has adopted the following objectives:
 - A. To provide maximum practical opportunities for Minority and Women's Business Enterprises (M/WBEs) to participate as suppliers and contractors for our organization.
 - B. To support the economic development of both small business enterprises and the minority community.
 - C. To provide Minorities and Women equal opportunities for participation in Capital Projects construction (additions, renovations and new construction), procurement, professional services, and system-wide purchasing contracts.
 - D. To provide procedures that will enable MUSC/MUHA to fulfill the goals of the State that are related to equal employment opportunities and affirmative actions in its construction contracts.
 - E. To provide procedures for determining and monitoring M/WBE participation and compliance with M/WBE requirements stated in the contract documents. Also, to provide procedures for the solution of complaints concerning discrimination against any businesses holding contracts with the MUSC/MUHA.
 - F. To evaluate and report to the M/WBE Small and Minority Business Advocate and to MUSC/MUHA the results of contract activity, subject to the provisions of the M/WBE Program.

2. In order to accomplish the objectives of the M/WBE Program, the following specific goals have been established:
 - A. To increase buying activities with Minority and Women's Enterprises that have the capability of providing construction services necessary for MUSC/MUHA operations.
 - B. To actively and diligently seek out Minority and Women's Enterprises who have the potential of becoming a source of construction services.
 - C. To promote awareness of the M/WBE Program throughout MUSC/MUHA and the Community.
 - D. To assist in the development of Minority and Women's Business Enterprise' to insure that maximum opportunities are given to actively compete for construction opportunities with MUSC/MUHA.

SECTION I

GUIDELINES FOR M/WBE PARTICIPATION IN CONSTRUCTION SERVICES

CONSTRUCTION

These guidelines are established to accomplish the goal of providing for minority participation in Single and Multi-Prime capital construction contracts. The Medical University of South Carolina shall have a verifiable percentage goal of participation by Minority and Women's businesses in the total value of work for each project for which a contract is awarded. These guidelines are published to accomplish that end.

ITEM 1:

INTENT

It is the intent of these guidelines that the Medical University of South Carolina and the contractors and subcontractors performing construction contracts for the Medical University of South Carolina shall cooperate, and in good faith, do all things legal, proper and reasonable to achieve the verifiable goal of 12% for participation by Minority and Women's businesses in each construction project. Nothing contained in these guidelines shall be considered to require awarding authorities to award contracts or to make purchases of materials or equipment from M/WBE contractors who do not submit the lowest responsive responsible bid or bids.

ITEM 2:

DEFINITIONS

1. Affirmative Action - A plan, or specific measurable steps, taken by an agency, business or individuals to fully involve Minority Business Enterprises and Women's Business Enterprises in contracts and programs and to assure non-discrimination and equal opportunities in the performance of work, contracts, or any elements of a project administered by MUSC/MUHA Minority/Women's Business Enterprise Program.
2. Bidder/Participant/Offeror - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.
3. Contract - A mutually-binding legal document which defines a business relationship or any modification at the level of performance which obligates the seller to furnish supplies, equipment, materials or services, knowledge in performing construction and procurements, and obligating the buyer to pay for services.
4. Contractor - Any person, firm, partnership, corporation, association, or joint venture that has been awarded a contract purchase or service agreement at any level with MUSC/MUHA or that has contracted with the Owner to perform construction work or repair.
5. Discrimination - Any action that distinguishes, differentiates, separates, or segregates one person or group from another, solely on the basis of age, race, religion, color, sex, national origin, handicap or veteran's status.
6. Goal - An objective, expressed numerically to evaluate the type and amount of contract awards and performance of Minority- and Women-owned business enterprises.
7. Good-Faith Effort - All activity performed by bidders to encourage the participation of minority and women's enterprises (M/WBE) in contracts covered under this plan.
8. Joint Venture - A legal merger of two or more businesses (separately-owned firms) for the purpose of submitting a single bid, to carry out a single business enterprise for profit, for which purpose they combine their property, capital, efforts, skills or knowledge.
9. MUSC - Medical University of South Carolina

10. MUHA – Medical University Hospital Authority
11. Minority (MBE) - a person who is a citizen or lawful permanent resident of the United States and who is:
 - (a) African-American, that is, a person having origins in any of the original racial groups in Africa;
 - (b) Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
 - (c) Native-American, that is, a person having origins in any of the original peoples of North America; or
 - (d) Asian-American, that is, persons having origin in any of the countries of the Far East, Southeast Asia, or the Indian areas.
12. Minority or Women's Business Enterprises-M/WBE - a business enterprise owned and controlled at a minimum of 51% by one or more members of a group defined as a minority or as women. A business certified as a minority- or woman-owned enterprise will show evidence of ownership and management interests and the daily business operations are real and continuing, not created solely to meet the M/WBE requirements.
13. Owner – Medical University of South Carolina/Medical University Hospital Authority
14. Owned and Controlled - A business which is (1) a sole proprietorship legitimately owned by an individual who is a member of a minority and/or female, (2) a partnership or joint venture controlled by minorities and/or females, and in which at least 51% of the beneficial ownership interests legitimately are held by minorities and/or females, or (3) a corporation or other entity controlled by minorities and/or females, and in which at least 51% of the voting interests are legitimately held by minorities and/or females. In addition, these persons must control the management and operation of the business on a day-to-day basis.
15. Subcontractor - A firm under contract with the prime contractor for supplying materials or labor and materials and/or installations. The subcontractor may or may not provide materials in his subcontract. Work subcontracted in an emergency and which could not have been anticipated is excluded as a part of this program.
16. Verifiable goal – For purposes of the Single-Prime contracts, the advertising authority has adopted written guidelines specifying the actions that the prime contractor should consider taking to ensure a good-faith effort in the recruitment and selection of minority and women's businesses for participation in contracts awarded; the required actions must be documented in writing by the contractor to the appropriate awarding authority.

PART 3:

RESPONSIBILITIES

1. Medical University of South Carolina/Medical University Hospital Authority - Owner

MUSC/MUHA under the Single and Multi Prime contract system will be responsible for the following:

- (a) For contracts in excess of \$500,000 estimated cost, notify Minority and Women's Business firms within twenty-one (21) days prior to the bid opening through means of advertising in the *South Carolina Business Opportunities* of the opportunities. Advertisements will include:
 1. Project description and location;
 2. Locations where bidding documents may be reviewed;
 3. Name of a representative of the Owner who can be contacted during the advertising period to advise who the prospective bidders are;
 4. Date, time and location of the bid opening.
 5. Date, time and location of pre-bid conference, if scheduled. The twenty-one day advance time period may be reduced to ten days for contracts in the range of \$100,000 to \$500,000 in the estimated cost.
- (b) The pre-bid conference, if scheduled, is conducted by the representative of the Owner, and will be open to all known and anticipated prime contractors, subcontractors, material suppliers, and other bidders.

2. Prime Contractor, Bidder or Offeror

Prime Contractors under the Single and Multi-Prime contract system will be responsible for the following:

- (a) Attend the scheduled mandatory pre-bid conference.
- (b) Identify or determine those work areas of a subcontract where M/WBEs may have an interest in performing subcontract work.
- (c) Submit, with the first application for payment, a description of the portion of the work to be executed by M/WBEs expressed as a percentage of the total contract price.
- (d) If the Contractor elects to use a M/WBE firm that is not certified by the Governor's Office of Small and Minority Business Assistance (OSMBA) the Contractor shall encourage the subcontractor to submit an application for certification within thirty (30) days of signing the Letter of Intent (Appendix II). If the firm does not submit an application within the specified time frame or fails to meet the certification criteria, the contract amount with that M/WBE firm will not be considered as M/WBE participation.
- (e) Upon being named the apparent low bidder, the Bidder shall submit to the Project Manager their good faith backup documentation if they have not met their M/WBE goal.
- (f) If, during the construction of a project, additional subcontracting opportunities become available, the prime or general contractors must make good-faith efforts to solicit sub-bids from M/WBEs.

3. M/WBE Responsibilities

M/WBE firms do not have to be certified to be listed on the bid documents; however, M/WBE firms that have been awarded contracts will not be credited towards MUSC/MUHA's M/WBE Program unless they are certified with the Governor's Office of Small and Minority Business Assistance (OSMBA).

- (a) M/WBEs should make every effort to establish contacts and relationships with contractors for potential future business, including attending pre-bid conferences and subscribing to industry and trade journals.
- (b) In addition, M/WBEs who are contacted by Owners or Bidders should respond promptly whether or not they wish to submit a bid. If an M/WBE firm is listed as a subcontractor or supplier, they will be responsible for completing a Letter of Intent (Appendix II) in a timely manner and returning it to the Prime Contractor.
- (c) M/WBE who are not certified at the time the firm commits to provide services, should apply for certification with the Governor's Office of Small and Minority Business Assistance (OSMBA) within thirty (30) days. If the M/WBE firm fails to submit an application within the specified time frame or if the M/WBE firm is not granted certification by the Certification Committee, that M/WBE firm's contract dollars will not be counted as M/WBE participation.

SECTION II

M/WBE CONTRACT PROVISIONS

ITEM 1: PROVISIONS FOR CONSTRUCTION

A. APPLICATION:

The requirements of the MUSC/MUHA Minority and Women's Business Enterprise (M/WBE) Provisions and Guidelines are hereby made a part of these contract documents. The requirements shall apply to all contractors regardless of ownership. Copies of the M/WBE Program may be obtained from the M/WBE Administrator, Engineering and Facilities, 97 Jonathan Lucas Street, P.O. Box 250190, Charleston, SC 29425.

B. M/WBE SUBCONTRACT GOALS:

The goals for participation by M/WBE as subcontractors on this project have been set at 12%.

The Bidder shall provide documented proof, with the first application for payment, in the form of Appendix I, M/WBE Utilization Commitment Form the percentage of M/WBE participation. Submit signed copies of Appendix II - Letters Of Intent to Perform as a Subcontractor, to the Project Manager.

C. COMPLIANCE DOCUMENTATION:

If the M/WBE subcontract goals are not achieved, the Bidder shall provide the following documentation to the Project Manager with the first application for payment:

1. M/WBE Utilization Commitment (Appendix I)
2. With the first pay application, the Bidder shall provide to the Project Manager signed Letters of Intent to Perform as a Subcontractor (Appendix II) for the M/WBE subcontractors listed on Appendix I.
3. After review of the Bidder's Good Faith Efforts, the Bidder may request and be granted a Waiver of the M/WBE goals that have not been met for that particular project. A Waiver may be granted upon review of the Bidder's documentation and determination that, in fact, a Good Faith Effort has been put forth.

NOTE: If the Bidder provides sufficient evidence on the M/WBE Utilization Commitment (Appendix I) that the goals have been met, or awards all subcontracts to M/WBEs, the Good Faith Efforts Documentation as listed above in #3 may not be required.

**APPENDIX I
M/WBE UTILIZATION COMMITMENT FORM
FOR
CONSTRUCTION**

We, _____, do certify that on the _____
 _____ (Bidder) _____ (Project Name)
 _____ (Project Number) _____ (Dollar Amount of Bid) we will expend a minimum of ____%

of the total dollar amount of the contract with Minority/Women Business Enterprises. M/WBEs will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

If the bidder intends to subcontract, this form must be completed irregardless of the amount of M/WBE participation attained.

| NAME OF FIRM | PHONE NUMBER | MBE OR WBE | Description of Work | Dollar Value |
|--------------|--------------|------------|---------------------|--------------|
| | | | | |
| | | | | |
| | | | | |

The undersigned will enter into a formal agreement with Minority/Women's Firms for work listed in this schedule conditional upon execution of a contract with the MUSC/MUHA.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____

 (Name & Phone No. of Authorized Officer)

Signature: _____

Title: _____

APPENDIX I OR APPENDIX II MUST BE SUBMITTED WITH THE FIRST APPLICATION FOR PAYMENT

**APPENDIX II
LETTER OF INTENT
TO
PERFORM AS A
SUBCONTRACTOR OR SUBCONSULTANT
(PROVIDE MATERIALS OR/ & SERVICES)**

PROJECT: _____
(Project Name)

TO: _____
(Name of Prime Bidder)

The undersigned intends to perform work in connection with the above project as

_____ Minority Business Enterprise _____ Women's Business Enterprise

_____ The M/WBE status of the undersigned is certified by the Governor's Office of Small and Minority Business Assistance. Our M/WBE certification number is _____.

_____ The M/WBE status of the undersigned is not certified by the Governor's Office of Small and Minority Business Assistance. Our application was submitted on _____.

The undersigned is prepared to perform the following described work or provide materials or services in connection with the above project (specify in detail particular work items, materials or services to be performed or provided) at the following price:

You have projected the following commencement date for such work, and the undersigned is projecting completion of such work as follows:

| Items | Projected Commencement Date | Projected Completion Date |
|-------|-----------------------------|---------------------------|
| | | |
| | | |
| | | |
| | | |

Subcontracting at any tier must be reported and is subject to all M/WBE compliance requirements. This form shall be used for M/WBE subcontracting at any level.

Date: _____
_____ (Name & Phone No. of M/WBE Company)

_____ (Name & Title of Authorized Office)

_____ (Signature)

THE PRIME CONTRACTOR MUST GET THIS FORM COMPLETED BY THE M/WBE SUBCONTRACTORS

**APPENDIX III
M/WBE DOCUMENTATION OF CONTRACT PAYMENTS FORM**

Prime Contractor: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority and Women Business Enterprises certified by the Governor's Office of Small and Minority Business Assistance on this project for the above mentioned period.

| <u>M/WBE FIRM NAME</u> | <u>INDICATE MBE OR WBE</u> | <u>OSMBA CERTIFICATION</u> | <u>AMOUNT TO BE PAID THIS PERIOD</u> | <u>TOTAL PAYMENTS TO DATE</u> |
|------------------------|--------------------------------|--------------------------------|------------------------------------------|-----------------------------------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

Date: _____

Name of Authorized Officer

Signature

Title

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

SE-355 PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____
Address: _____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____
Address: _____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: Medical University of South Carolina
Address: 97 Jonathan Lucas St.
Charleston, SC 29425

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____ (\$ _____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

State Project Name: Storm Eye Optical Shop
State Project Number: H51-50068

Brief Description of Awarded Work: Selective demo and 2-phase renovation of existing 1st floor waiting area for new Optical Shop. Phase 1 renovates existing exam areas into new waiting area and 2 new exam rooms. Phase 2 will be to renovate the original waiting area into a new optical display/sales area. Project includes architectural, mechanical, electrical and fire protection and includes installation of new fire rated glass wall. Contractor required to coordinate installation of casework provided/installed by Owner's vendor.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: Rosenblum Coe Architects, Inc.
Address: 1643 Means St.
Charleston, SC 29412

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____ **day of** _____, **2** _____
(shall be no earlier than Date of Contract)

BOND NUMBER _____

CONTRACTOR

SURETY

By: _____
(Seal)

By: _____
(Seal)

Print Name: _____

Print Name: _____

Print Title: _____

Print Title: _____
(Attach Power of Attorney)

Witness: _____

Witness: _____

(Additional Signatures, if any, appear on attached page)

SE-355**PERFORMANCE BOND****NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:**

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency for the full and faithful performance of the contract, which is incorporated herein by reference.
2. If the Contractor performs the contract, the Surety and the Contractor have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.
3. The Surety's obligation under this Bond shall arise after:
 - 3.1 The Agency has notified the Contractor and the Surety at the address described in paragraph 10 below, that the Agency is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If the Agency, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the Agency's right, if any, subsequently to declare a Contractor Default; or
 - 3.2 The Agency has declared a Contractor Default and formally terminated the Contractor's right to complete the Contract.
4. The Surety shall, within 15 days after receipt of notice of the Agency's declaration of a Contractor Default, and at the Surety's sole expense, take one of the following actions:
 - 4.1 Arrange for the Contractor, with consent of the Agency, to perform and complete the Contract; or
 - 4.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Agency for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the Agency and the contractor selected with the Agency's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to the Agency the amount of damages as described in paragraph 7 in excess of the Balance of the Contract Sum incurred by the Agency resulting from the Contractor Default; or
 - 4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and:
 - 4.4.1 After investigation, determine the amount for which it may be liable to the Agency and, within 60 days of waiving its rights under this paragraph, tender payment thereof to the Agency; or
 - 4.4.2 Deny liability in whole or in part and notify the Agency, citing the reasons therefore.
5. Provided Surety has proceeded under paragraphs 4.1, 4.2, or 4.3, the Agency shall pay the Balance of the Contract Sum to either:
 - 5.1 Surety in accordance with the terms of the Contract; or
 - 5.2 Another contractor selected pursuant to paragraph 4.3 to perform the Contract.
 - 5.3 The balance of the Contract Sum due either the Surety or another contractor shall be reduced by the amount of damages as described in paragraph 7.
6. If the Surety does not proceed as provided in paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond 15 days after receipt of written notice from the Agency to the Surety demanding that the Surety perform its obligations under this Bond, and the Agency shall be entitled to enforce any remedy available to the Agency.
 - 6.1 If the Surety proceeds as provided in paragraph 4.4 and the Agency refuses the payment tendered or the Surety has denied liability, in whole or in part, then without further notice the Agency shall be entitled to enforce any remedy available to the Agency.
 - 6.2 Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the Dispute Resolution process defined in the Contract Documents and the laws of the State of South Carolina.
7. After the Agency has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Agency shall be those of the Contractor under the Contract, and the responsibilities of the Agency to the Surety shall be those of the Agency under the Contract. To a limit of the amount of this Bond, but subject to commitment by the Agency of the Balance of the Contract Sum to mitigation of costs and damages on the Contract, the Surety is obligated to the Agency without duplication for:
 - 7.1 The responsibilities of the Contractor for correction of defective Work and completion of the Contract; and
 - 7.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under paragraph 4; and
 - 7.3 Damages awarded pursuant to the Dispute Resolution Provisions of the Contract. Surety may join in any Dispute Resolution proceeding brought under the Contract and shall be bound by the results thereof; and
 - 7.4 Liquidated Damages, or if no Liquidated Damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor.
8. The Surety shall not be liable to the Agency or others for obligations of the Contractor that are unrelated to the Contract, and the Balance of the Contract Sum shall not be reduced or set-off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Agency or its heirs, executors, administrators, or successors.
9. The Surety hereby waives notice of any change, including changes of time, to the contract or to related subcontracts, purchase orders and other obligations.
10. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the address shown on the signature page.
11. Definitions
 - 11.1 Balance of the Contract Sum: The total amount payable by the Agency to the Contractor under the Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts to be received by the Agency in settlement of insurance or other Claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Contract.
 - 11.2 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform the Contract or otherwise to comply with the terms of the Contract.

SE-357
LABOR & MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____
Address: _____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____
Address: _____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: Medical University of South Carolina
Address: 97 Jonathan Lucas St.
Charleston, SC 29425

hereinafter referred to as "Agency", or its successors or assigns, the sum of _____ (\$ _____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Agency to construct

State Project Name: Storm Eye Optical Shop
State Project Number: H51-50068

Brief Description of Awarded Work: Selective demo and 2-phase renovation of existing 1st floor waiting area for new Optical Shop. Phase 1 renovates existing exam areas into new waiting area and 2 new exam rooms. Phase 2 will be to renovate the original waiting area into a new optical display/sales area. Project includes architectural, mechanical, electrical and fire protection and includes installation of new fire rated glass wall. Contractor required to coordinate installation of casework provided/installed by Owner's vendor.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: Rosenblum Coe Architects, Inc.
Address: 1643 Means St.
Charleston, SC 29412

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Labor & Material Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____ **day of** _____, **2** _____ **BOND NUMBER** _____
(shall be no earlier than Date of Contract)

CONTRACTOR

SURETY

By: _____
(Seal)

By: _____
(Seal)

Print Name: _____

Print Name: _____

Print Title: _____

Print Title: _____
(Attach Power of Attorney)

Witness: _____

Witness: _____

(Additional Signatures, if any, appear on attached page)

SE-357**LABOR & MATERIAL PAYMENT BOND****NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:**

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency to pay for all labor, materials and equipment required for use in the performance of the Contract, which is incorporated herein by reference.
 2. With respect to the Agency, this obligation shall be null and void if the Contractor:
 - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants; and
 - 2.2 Defends, indemnifies and holds harmless the Agency from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract.
 3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.
 4. With respect to Claimants, and subject to the provisions of Title 29, Chapter 5 and the provisions of §11-35-3030(2)(c) of the SC Code of Laws, as amended, the Surety's obligation under this Bond shall arise as follows:
 - 4.1 Every person who has furnished labor, material or rental equipment to the Contractor or its subcontractors for the work specified in the Contract, and who has not been paid in full therefore before the expiration of a period of ninety (90) days after the date on which the last of the labor was done or performed by him or material or rental equipment was furnished or supplied by him for which such claim is made, shall have the right to sue on the payment bond for the amount, or the balance thereof, unpaid at the time of institution of such suit and to prosecute such action for the sum or sums justly due him.
 - 4.2 A remote claimant shall have a right of action on the payment bond upon giving written notice by certified or registered mail to the Contractor within ninety (90) days from the date on which such person did or performed the last of the labor or furnished or supplied the last of the material or rental equipment upon which such claim is made.
 - 4.3 Every suit instituted upon a payment bond shall be brought in a court of competent jurisdiction for the county or circuit in which the construction contract was to be performed, but no such suit shall be commenced after the expiration of one year after the day on which the last of the labor was performed or material or rental equipment was supplied by the person bringing suit.
 5. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:
 - 5.1 Send an answer to the Claimant, with a copy to the Agency, within sixty (60) days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
 - 5.2 Pay or arrange for payment of any undisputed amounts.
 - 5.3 The Surety's failure to discharge its obligations under this paragraph 5 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a claim. However, if the Surety fails to discharge its obligations under this paragraph 5, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.
 6. Amounts owed by the Agency to the Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By the Contractor furnishing and the Agency accepting this Bond, they agree that all funds earned by the contractor in the performance of the Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Agency's prior right to use the funds for the completion of the Work.
 7. The Surety shall not be liable to the Agency, Claimants or others for obligations of the Contractor that are unrelated to the Contract. The Agency shall not be liable for payment of any costs or expenses of any claimant under this bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
 8. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.
 9. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the Agency or the contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
 10. By the Contractor furnishing and the Agency accepting this Bond, they agree that this Bond has been furnished to comply with the statutory requirements of the South Carolina Code of Laws, as amended, and further, that any provision in this Bond conflicting with said statutory requirements shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
 11. Upon request of any person or entity appearing to be a potential beneficiary of this bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.
 12. Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the laws of the State of South Carolina.
- 13. DEFINITIONS**
- 13.1 Claimant: An individual or entity having a direct contract with the Contractor or with a Subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of the Contractor and the Contractor's Subcontractors, and all other items for which a mechanic's lien might otherwise be asserted.
 - 13.2 Remote Claimant: A person having a direct contractual relationship with a subcontractor of the Contractor or subcontractor, but no contractual relationship expressed or implied with the Contractor.
 - 13.3 Contract: The agreement between the Agency and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

SE-380

CHANGE ORDER NO.: _____

CHANGE ORDER TO DESIGN-BID-BUILD CONSTRUCTION CONTRACT

AGENCY: Medical University of South Carolina

PROJECT NAME: Storm Eye Institute Optical Shop

PROJECT NUMBER: H51-50068

CONTRACTOR: _____ **CONTRACT DATE:** _____

This Contract is changed as follows: *(Insert description of change in space provided below)*

ADJUSTMENTS IN THE CONTRACT SUM:

| | | |
|-----------------------------------------------------------------|--|---------|
| 1. Original Contract Sum: | | \$ |
| 2. Change in Contract Sum by previously approved Change Orders: | | |
| 3. Contract Sum prior to this Change Order | | \$ 0.00 |
| 4. Amount of this Change Order: | | |
| 5. New Contract Sum, including this Change Order: | | \$ 0.00 |

ADJUSTMENTS IN THE CONTRACT TIME:

| | | |
|----------------------------------------------------------------|--|------|
| 1. Original Substantial Completion Date: | | |
| 2. Sum of previously approved increases and decreases in Days: | | Days |
| 3. Change in Days for this Change Order | | Days |
| 4. New Substantial Completion Date: | | |

CONTRACTOR ACCEPTANCE:

BY: _____ **Date:** _____
(Signature of Representative)

Print Name of Representative: _____

A/E RECOMMENDATION FOR ACCEPTANCE:

BY: _____ **Date:** _____
(Signature of Representative)

Print Name or Representative: _____

AGENCY ACCEPTANCE AND CERTIFICATION:

BY: _____ **Date:** _____
(Signature of Representative)

Print Name of Representative: _____

Change is within Agency Construction Contract Change Order Certification of: \$ _____ **Yes** **No**

AUTHORIZED BY: _____ **DATE:** _____
(OSE Project Manager)

SUBMIT THE FOLLOWING TO OSE

1. SE-380, fully completed and signed by the Contractor, A/E and Agency;
2. Detailed back-up information, with OH&P shown, from the Contractor/Subcontractor(s) that justifies the costs and schedule changes shown.
3. If any item exceeds Agency certification, OSE will authorize the SE-380 and return to Agency.

DOCUMENT 003119 - EXISTING CONDITION INFORMATION

1.1 EXISTING CONDITION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. Existing drawings that include information on existing conditions including previous construction at Project site are available for viewing at the Owner's Plan Room by a request of bidders via pdf.
- C. Related Requirements:
 - 1. Document AIA A701 "Instructions to Bidders" located in the Project Manual for the Bidder's responsibilities for examination of Project site and existing conditions.
 - 2. Document 003126 "Existing Hazardous Material Information" for hazardous materials reports that are made available to bidders

END OF DOCUMENT

DOCUMENT 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. The Owner is not aware of any existing hazardous materials within the limits of construction. This includes but is not limited to asbestos, lead based paint, or PBCs. Given the age of the existing building, and recent renovations it is assumed previous project's abated any hazardous materials.
- C. Related Requirements:
 - 1. Document AIA A701 "Instructions to Bidders" located in the Project Manual for the Bidder's responsibilities for examination of Project site and existing conditions.
 - 2. Document 003119 "Existing Condition Information" for information about existing conditions that is made available to bidders.
 - 3. Section 024119 "Selective Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.

END OF DOCUMENT

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Sole source providers.
7. Purchase contracts.
8. Owner-furnished, Owner-installed products.
9. Owner-furnished, Contractor-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and drawing conventions.
14. Miscellaneous provisions.

- B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: STORM EYE INSTITUTE OPTICAL SHOP, project no. H51-50068.
 1. Project Location: MUSC STORM EYE INSTITUTE, 167 Ashley Ave, Charleston, SC 29425.
- B. Owner: Medical University Hospital Authority (MUHA).
 1. Owner's Representative: Mr. Wade Lewis Gatlin, AIA, Project Manager, 97 Jonathan Lucas St., Charleston, SC 29425, phone 843.792.2233.
- C. Architect: Rosenblum Coe Architects Inc, 1643 Means St, Charleston, SC 29412, phone 843.577.6073.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work is defined by the Contract Documents and consists of the following:

- B. Selective demo and 2-phase renovation of existing 1st floor waiting area for new Optical Shop. Phase 1 renovates existing exam areas into new waiting area and 2 new exam rooms. Phase 2 will be to renovate the original waiting area into a new optical display/sales area. Project includes architectural, mechanical, electrical and fire protection and includes installation of new fire rated glass wall. Contractor required to coordinate installation of casework provided/installed by Owner's vendor. Insert additional paragraphs for other major items of work.
- C. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.5 PHASED CONSTRUCTION

- A. The Work shall be conducted in Two phases, with each phase substantially complete as indicated:
 - 1. Phase One: Renovation of 4 existing exam rooms on 1st floor into new waiting room and 2 reconfigured exam rooms. Work of this phase shall commence 7 days after the Notice to Proceed and be complete and ready for occupancy in a number of days to be determined by the Contractor and approved by the Owner.
 - 2. Phase Two: The remaining Work shall be Substantially Complete and ready for occupancy at time of Substantial Completion of the Work.
 - a. Total Project shall be Substantially Complete within 120 days after the Notice To Proceed with the Work.
- B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

1.6 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.7 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 - 1. Optical Display Casework: To "Eye Designs" for fabrication, delivery, and installation of optical display casework. Contractor shall be responsible for providing space ready for the casework to be installed. Contractor shall be responsible for final electrical connections to Owner provided casework.
- C. Exclusive Separate Contracts: MUHA shall contract with and provide payment to the subcontractors listed below. MUHA shall supply these vendors with a copy of all construction documents required to perform the listed construction activities. General Contractor shall include the listed construction activities on their schedule and shall coordinate all work directly with the contractor to maintain their

schedule. These vendors will provide their services in compliance with all MUHA standards for their work so there will be no problems with warranties. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1. **Voice/Data Cabling:** To **RW Wiring** for demo, install, circuit activation of all telephone/data cables and receptacles. Demo and install of all security cables. Demo and install of all cable television cables. (Conduit and boxes provided by others).
2. **HazMat Testing and Abatement.**

1.8 SOLE SOURCE PROVIDERS

- A. General: The following contractors must be used exclusively for the listed construction activities unless approved in advance with the MUHA Project Manager. General Contractor should contract with these vendors directly. General Contractor shall supply these vendors with a copy of all construction documents required to perform the listed construction activities. These vendors will provide their services in compliance with all MUHA standards for their work so there will be no problems with warranties.
1. **Security:** *SFI Electronics, Inc., 400 Clanton Road, Suite A, Charlotte, NC; 704-522-0800* for cameras, card readers, fire doors programming / door controls (mag locks, etc.).
 2. **Fire Protection – Fire Alarm Systems:** for fire alarm system purchase and installation (i.e. demo, install, & tie-in of smoke detectors, pull stations, annunciators, etc. / programming of fire alarm system).
 - a. For Work in Rutledge Tower and Ashley River Tower Buildings: *Simplex Grinnell, 5935 Rivers Avenue, Suite 105, North Charleston, SC 29406; 843-747-5254*
 - b. For Work in All Other Buildings: *L&S Electronics, Inc., 5911 Loftis Road, #B, Hanahan, SC; (843) 554-5900*
 3. **Fire Protection –Sprinkler Systems:** *VSC Fire & Security, 453 Jessen Lane, Charleston, SC 29492; 843-416-1312.* Supply and installation of all sprinklers, fire department connections, fire pumps, stand pipes, and related items.
 4. **HVAC Controls:** *Johnson Controls, 3900 Leeds Avenue, N. Charleston, SC; 843-744-7144* for HVAC Controls - must be compatible with JCI Metasys system / HVAC programming.

1.9 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OF/CI) PRODUCTS

- A. Owner will furnish products indicated for installation by Contractor. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. OF/CI Products:
1. Document Reference: Refer to Drawing No. E601 Light Fixture Schedule for lamps supplied by the Owner and Installed by the Contractor..

1.10 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated for each phase. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to areas within the limits of construction for each phase as shown on the Drawings, with the exception of delivery routes for material delivery and disposal thru adjacent corridor HA1FL and vestibule HA132. Any damage to existing corridor and vestibule will be the Contractor's responsibility to repair to "preconstruction condition".
 - 2. Driveways, Walkways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations.

1.11 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing and adjacent building(s) and spaces during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Activities that will affect Owner's operations will require advance notification and permits as specified in specification.
- B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Activities that will affect Owner's operations will require advance notification and permits as specified in specification.
- C. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.12 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Hospital Environment: Comply with hospital and safety requirements/permits as stated in Section 015120 – Environment of Care and Safety Compliance, and as directed by Owner.
- C. Controlled Substances: Use of tobacco products and other controlled substances on the MUSC/MUHA campus is not permitted, as stated in Section 015120 3.4 J.
- D. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 AM to 7:00 PM, Monday through Friday, except as otherwise indicated.
 1. After Hours and Weekend work must be coordinated with MUHA Project Manager with enough notice to allow users at least 48 hours advance notice.
 2. Deliveries of equipment or materials to the construction site must occur before 7:00am or after 7:00pm unless arranged in advance with the MUHA Project Manager.
 3. Noisy or disruptive demolition and construction activities must occur after hours and be coordinated with MUSC.
- E. Existing Corridors: No tool or equipment storage permitted in existing corridors.
- F. Sprinkler Shutdowns: No more than 1 sprinkler shutdown permitted per week, unless approved in writing by Owner.
- G. Existing Utility Interruptions: Comply with hospital and safety requirements/permits as stated in Section 015120 – Environment of Care and Safety Compliance, and as directed by Owner.
- H. Debris Removal: Debris removal must be done between 5:00 PM and 7:00 AM through designated routes coordinated with Owner’s representative. All debris shall be inside clean enclosed, covered containers.
 1. When corridors are used for trash removal, damp mop corridor after every trash trip.
 2. Trash / Construction debris dumpsters will be provided by **Contractor** in designated locations located in the adjacent “horseshoe”. Coordinate final location with MUSC prior to dumpster delivery.
- I. Noise, Vibration, and Odors: Comply with hospital and safety requirements/permits as stated in Section 015120 – Environment of Care and Safety Compliance, and as directed by Owner.
- J. Employee Identification: Owner will provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
- C. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Lump-Sum Allowance: Include the sum of \$5,000.00 to furnish materials and supply labor to level entire floor within limits of construction with hydraulic cement where required after completion of demolition. See Specification Section 035416 "Hydraulic Cement Underlayment." After demolition and prior to installation, Contractor shall confirm extents of hydraulic cement underlayment required to achieve level floor acceptable to finish flooring manufacturer. Written documentation of required quantity (thickness and total labor and material) to be provided for Owner/Architect review. Any unused allowance to be credited to the Owner via Change Order.
 - 1. This allowance includes material cost, receiving, handling, and installation.
 - 2. Coordinate lump sum allowance adjustment with corresponding unit-price requirements in Section 012200 "Unit Prices."

- B. Allowance No. 2: Lump-Sum Allowance: Include the sum of \$2,500.00 to furnish materials and supply labor to patch existing penetrations and openings above ceiling in the rated wall separating the new optical shop and existing elevator corridor. This allowance does not include the Work as required to cut the wall opening to accommodate the new rated window, which shall be included in the Base Bid. The allowance is only to make repairs to the areas above ceiling that cannot be fully observed until the existing ceiling is removed as part of selective demolition.
 - 1. This allowance includes material cost, receiving, handling, and installation.
 - 2. Coordinate quantity allowance adjustment with corresponding unit-price requirements in Section 012200 "Unit Prices."

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1 – Firestopping of Top of Gypsum Wall:
 - 1. Description: Firestop top of rated gypsum wall assembly (similar to Hilti System No. HW-D-0083), which is not shown or reasonably inferred from Contract Documents.
 - 2. Unit of Measurement: Square Foot.

- B. Unit Price No. 2 – Firestopping of Cable Bundle Through Gypsum Wall:
 - 1. Description: Firestop cable bundle through smoketight and rated gypsum wall assemblies, with maximum 4-inch diameter opening (similar to Hilti System No. W-L-3111), which are not shown or reasonably inferred from Contract Documents.
 - 2. Unit of Measurement: Cubic Inch of fill material.

- C. Unit Price No. 3 – Firestopping of Small & Medium Insulated Metal Pipe Through Gypsum Wall:
 - 1. Description: Firestop small and medium insulated metallic pipe or tubing penetrations through smoketight and rated gypsum wall assemblies, with maximum 7-1/2-inch diameter opening (similar to Hilti System No. W-L-5028), which are not shown or reasonably inferred from Contract Documents.
 - 2. Unit of Measurement: Cubic Inch of fill material.

- D. Unit Price No. 4 – Concrete Fill for Small Floor Openings:
 - 1. Description: Fill small openings (less than 144 sq. in.) in concrete floor, which are not shown or reasonably inferred from Contract Documents.
 - 2. Unit of Measurement: Each.

- E. Unit Price No. 5 – Fire-Rated Drywall Partition:
 - 1. Description: Provide infill steel stud, gypsum board and sound attenuation fire blankets to existing fire-rated assemblies.
 - 2. Unit of Measurement: Square Foot.

- F. Unit Price No. 6 – Supports:
 - 1. Description: Provide additional supports for existing piping/conduit.
 - 2. Unit of Measurement: Linear Foot.

- G. Unit Price No. 7 – Fiberglass Pipe Insulation:
 - 1. Description: Replace existing fiberglass pipe insulation and provide insulation on pipes that should be insulated.
 - 2. Unit of Measurement: Linear Foot.

- H. Unit Price No. 8 – Tagging Valves:
 - 1. Description: Provide valve tag.

2. Unit of Measurement: Each.
- I. Unit Price No. 9 – Tagging/Labeling Piping:
 1. Description: Provide pipe tag/label.
 2. Unit of Measurement: Each.
 - J. Unit Price No.10 - Junction Box Covers:
 1. Description: Provide junction box covers o existing electrical boxes missing covers.
 2. Unit of Measurement: per cover cost including installation.
 - K. Unit Price No. 11 - Support existing light fixture:
 1. Description: Provide support of existing light fixtures to meet seismic requirements.
 2. Unit of Measurement: support, per light, to existing structure.
 - L. Unit Price No. 12 – Hydraulic Cement Underlayment
 1. Description: Provide Hydraulic Cement Underlayment on existing slab to achieve suitable substrate for new floor finishes.
 2. Unit of Measurement: Price per bag of underlayment.

END OF SECTION 012200

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions after award of Contract.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit electronic submittal of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form provided in Project Manual. Submit one electronic form and one hardcopy.
 - a. Use attached 012500A "Substitution Request Form".
 - b. Comply with Section 014240 - MUHA Documentation Standards.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 14 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

DOCUMENT 012500A - SUBSTITUTION REQUEST FORM

COMPLETE AND SUBMIT THIS FORM FOR APPROVAL OF SUBSTITUTES. ELECTRONIC SUBMISSION SHALL BE MADE FOR EACH PROPOSED SUBSTITUTE ITEM IN ACCORDANCE WITH SECTION 014240 - MUHA DOCUMENTATION STANDARDS.

TO: _____ [Project Architect Name and E-mail]

PROJECT NAME: _____

SPECIFIED ITEM PROPOSED TO BE REPLACED:

| Section | Paragraph | Specified Item |
|---------|-----------|----------------|
| _____ | _____ | _____ |

PROPOSED SUBSTITUTION:

1) Attach complete technical data, including laboratory tests, samples, certificates and qualification data, material test reports, and research reports if applicable.

2) Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

3) Provide the following information detailing the effect the substitution will have on the project.:

A. Does the substitution affect dimensions shown on the drawings?

Yes ____ No ____

B. Coordination Information. Include a list of changes or revisions needed to other parts of the Work and to construction performed by the Owner and Separate Contractors that will be necessary to accommodate the proposed substitution (attach additional sheets if necessary).

C. Reason the specified product cannot be provided (attach additional sheets if necessary).

D. List of similar installations for completed projects with (i) project names and addresses, (ii) names and addresses of Owners, and (iii) names and addresses of Design Professionals (attach additional sheets if necessary).

- E. Detailed comparison of significant qualities of proposed substitution with products specified for the Work. (attach additional sheets if necessary).

- F. Detailed comparison of Contractor's construction schedule with specified product vs. construction schedule showing impact with proposed product. (attach additional sheets if necessary).

- G. Cost and/or Time changes to the Contract. Attach a Change Request Form, if any.

- H. Manufacturer's guarantees of proposed and specified items are:
Same ___ Different ___ (explain below and on attachments)

- I. Benefit to Owner:

The Undersigned states that (i) the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item; (ii) the proposed substitution complies with the requirements in the Contract Documents except as indicated in this Substitution Request Form, is compatible with related materials, and is appropriate for applications indicated; and (iii) and that all rights are waived to additional payment or time that may subsequently become necessary because of failure of proposed substitution to provide indicated results.

Submitted by:

Print Name

Signature

Title

Date

Firm

Address

City/State/Zip

Telephone

Fax

For Use by Design Consultant

Accepted

Accepted as Noted

Not Accepted

Received Too Late

Signature

Printed Name

Date

NOTES:

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue AIA Document G709 "Work Changes Proposal" with a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 14 calendar days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship.
 - e. Quotation Form: Use forms acceptable to Architect.
 - f. Include an itemized account and supporting data necessary to substantiate cost and time adjustments.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a Change Order Request Form to Architect.
 - 1. Change Order Request Form. Submit one electronic form to Architect and Owner.
 - a. Use attached 012600A "Change Order Request Form"
 - b. Comply with 014240 "MUHA Documentation Standards".
 - 2. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 3. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 5. Include costs of labor and supervision directly attributable to the change.
 - 6. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship.
 - 7. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 8. Include an itemized account and supporting data necessary to substantiate cost and time adjustments.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on Owner-provided form.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on Owner-provided form. Construction Change Directive instructs Contractor to proceed with a change in the Work.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

012600A - CHANGE ORDER REQUEST (COR) FORM

DATE: CHANGE ORDER REQUEST NO.:

PROJECT NUMBER:

PROJECT NAME:

COR TYPE: User Request: Unforeseen: Error/Omission:

COR DESCRIPTION:

| | | (1) Contractor | (2) 1st Tier Subs | (3) 2nd Tier Subs | (4) TOTAL |
|--------------|--------------------------------------------------------------|-------------------|----------------------|----------------------|--------------|
| Direct Costs | 1. Straight Time Wages/Salaries - Labor | | | | \$ - |
| | 2. Benefits and Payroll Taxes - Labor (___% of Line 1) | | | | \$ - |
| | 3. Overtime Time Wages/Salaries - Labor | | | | \$ - |
| | 4. Benefits and Payroll Taxes - Labor (___% of Line 3) | | | | \$ - |
| | 5. Materials & Consumable Items | | | | \$ - |
| | 6. Sales Taxes (___% of Line 5) | | | | \$ - |
| | 7. Equipment Rental Charges (attach schedule) | | | | \$ - |
| | 8. Permits & Fees | | | | \$ - |
| | 9. Other | | | | \$ - |
| | 10. SUBTOTAL DIRECT EXPENSES: | \$ - | \$ - | \$ - | \$ - |
| Bonds | 11. BONDS AND INSURANCE: (applied to Line 10) | | | | \$ - |
| OH&P | 12. CONTRACTOR OVERHEAD & PROFIT: (15% of Line 10 TOTAL) | | | | \$ - |
| | 13. TOTAL CHANGE ORDER COST: (sum of Line 10, 11, and 12) | | | | \$ - |

- 1) Complete this form by providing the information in the highlighted fields.
- 2) Provide the sequential Change Order Request # (COR#) corresponding to that on the Change Order Log
- 3) Round all amounts to the nearest dollar.

DOCUMENT 012600B - CHANGE ORDER TO CONSTRUCTION CONTRACT

OWNER: Medical University Hospital Authority
PROJECT NUMBER: _____
PROJECT NAME: _____
CHANGE ORDER NUMBER: _____ **DATE:** _____

NOTE: Change Orders must be approved by the Owner prior to the Contractor performing any work.

1) Description of Adjustment in the Contract Scope and/or Time. (REFERENCE ANY ATTACHMENTS BY NAME AND DATE).

2) Adjustments in the Contract Sum
 (**NOTE:** The allowances for overhead and profit combined shall not exceed the percentages indicated in the Supplementary Conditions):

- a) Original Contract Sum: \$ _____
- b) Change by previously approved Change Orders: \$ _____
- c) Contract Sum prior to this Change Order: \$ _____
- d) Amount of this Change Order, including overhead and profit: \$ _____
- e) New Contract Sum, including this Change Order: \$ _____

- 3) Adjustments in the Contract Time:
- a) Original Date for Substantial Completion: _____
 - b) Change in days by previously approved Change Orders: _____ Days
 - c) Change in days for this Change Order: _____ Days
 - d) New Date for Substantial Completion: _____

REASON FOR CHANGE ORDER BREAKDOWN

| | | | |
|---------------------------------|--|------------------------------|--|
| Additional Funds: | | Additional Days: | |
| Errors and Omissions: \$ _____ | | Errors and Omissions: _____ | |
| Unforeseen Conditions: \$ _____ | | Unforeseen Conditions: _____ | |
| Owner's Request: \$ _____ | | Owner's Request: _____ | |

(Contractor Signature) _____
(Date)

(Print Contractor Name and Title)

(Print Contractor Firm Name)

(Architect/Engineer Signature) _____
(Date)

(Print Architect/Engineer Name and Title)

(Print Architect/Engineer Firm Name)

(MUHA Signature) _____
(Date)

(Print Name and Title)

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
 - 5. Section 017700 "Closeout Procedures" for procedures related to final application for payment.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule, such as coordination drawings, submittals, operation and maintenance manuals and as-built markups.
 - 2. Submit the schedule of values to Architect and Owner at earliest possible date, but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub-schedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values coordinated with each phase of payment.

4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
 - a. MUSC project name, MUSC project number and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents and with Architect and Owner. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout procedures in an amount totaling five percent of the Contract Sum and subcontract amount.
 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Submit Application for Payment to Architect by the first day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Applications may include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

- F. Transmittal: Submit an electronically scanned, signed and notarized original copy of each Application for Payment to Architect by electronic mail. Copy shall include attachments if required.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors per Section 013100 requirements.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's principal consultants.
 7. Copies of building permits.
 8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 9. Initial progress report.
 10. Report of preconstruction conference.
 11. Certificates of insurance and insurance policies.
 12. Performance and payment bonds.
 13. Data needed to acquire Owner's insurance.
 14. Coordination drawings (progress set).
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements per Section 017700 – Closeout Procedures, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G707, "Consent of Surety to Final Payment."
 6. Evidence that claims have been settled.
 7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Submit electronic copy with initial application for payment. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 14 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Contractor shall update as necessary to keep list current at all times.

- C. Contractor and subcontractors shall submit individual MUHA Contractor Badge Requests electronically to Owner for each employee that has potential to work on MUSC/MUHA property.
 - 1. Use attached 013100A "MUHA Contractor Badge Request" form
 - 2. Comply with 014240 "MUHA Documentation Standards"
 - 3. Badge Requests must be submitted no less than five days prior to beginning of work by each employee.
 - 4. Contractor's employees must wear badges in a visible location at all times they are working on MUSC/MUHA property. Workers not displaying a visible badge may be asked to leave MUSC/MUHA property.

1.5 GENERAL COORDINATION PROCEDURES

- A. General 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination with Owner's Sole Source Providers: Contractor shall coordinate its construction operations with those of subcontractors and entities such as Owner's Sole Source Providers to ensure efficient and orderly installation of each part of the Work. Contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- 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, including Owner's sole source providers, 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. Pre-installation conferences.

7. Project closeout activities.
8. Startup and adjustment of systems.

E. Personnel:

1. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
2. Contractor Badges: All Contractors, sub-contractors and other workers associated with accomplishing the Work are required to get a MUHA Construction Identification Badge, prior to coming to construction site. This badge shall be worn at all times when present at the site.

F. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste. See Section 024119 "Selective Structure Demolition" for disposition of salvage materials.

1. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

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

C. RFI Forms: AIA Document G716.

1. RFI Forms and attachments shall be electronic files in Adobe Acrobat PDF format.

2. RFI electronic files shall be named as follows: "MUSC H51-50068 RFI # <Insert number> Submittal".
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven calendar days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - h. Request submitted by other entities controlled by Contactor.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 calendar days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at each construction progress meeting. Include the following on a form acceptable to Architect:
1. MUHA project name and number.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
 8. Date of resubmittals of RFI, if necessary.
 9. Date of Architect's response to resubmittals, if necessary.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven calendar days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- 1.7 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: Entity responsible for conducting meeting will 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: Architect will schedule with Owner and conduct 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.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, as applicable, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises and existing building.
 - n. Work restrictions, including EOC permit responsibility.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Pre-installation Conferences: Contractor will schedule and conduct a pre-installation 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 and Owner's Commissioning Authority, if applicable, of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Architect shall schedule and conduct a project closeout conference, at a time convenient to Owner and Contractor, but no later than 7 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, if applicable, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for completing regulatory compliance documentation.
 - e. Requirements for preparing and submitting operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.

- g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Coordination of separate contracts.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
 - o. Reconcile the RFI log with Owner-received submittals.
 - p. Reconcile the Submittal log with Owner-received submittals.
 - q. Reconcile the Change Order log.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Contractor shall schedule and conduct progress meetings at monthly intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner Owner's Commissioning Authority, if applicable, 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. 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. Discuss objectives for meeting milestone dates that fall within next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Status of record and regulatory compliance documentation.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.

- 18) Pending claims and disputes.
- 19) Documentation of information for payment requests.
- 20) Minutes of Coordination Meeting.
- 21) Application for Payment Draft

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

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

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

1. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8 CONTRACTOR SAFETY TRAINING

A. Implement Contractor Safety Training Program and procure Safety Training Badges for all Contractor employees per 015120 "Environment of Care (EOC) and Safety Compliance"..

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

DOCUMENT 013100A - MUHA CONTRACTOR BADGE REQUEST

A CONTRACTOR PERFORMING WORK ON THE MUSC / MUHA CAMPUS IS RESPONSIBLE FOR:

- 1) Completing the following information for all employees of the contractor and/or subcontractors that will be on the MUSC / MUHA campus for project related work. A separate Contractor Badge Request must be filled out for each individual project on which a contractor/subcontractor employee is working as each project can have a different MUHA sponsor for these badges.
- 2) Submitting these forms to the MUHA Project Manager via email or at the MUHA Construction & Design Office (326 Calhoun Street, MSC 109, Charleston, SC 29425). Contractor Badge Requests should be submitted at least 5 working days before construction start date.
- 3) Informing the MUHA Project Manager if any employee who has received a badge is no longer working on the MUSC / MUHA campus and returning the badge to the Public Safety Building (101 Doughty Street, Charleston, SC 29425).

COMPANY NAME: _____

FIRST NAME: _____

MIDDLE NAME: _____

LAST NAME: _____

JOB TITLE: _____

DATE OF BIRTH: _____

SS# _____

MUHA PROJ. MANAGER: _____

START DATE: _____

EXPECTED FINISH DATE: _____

Badges will not be issued unless ALL the above information is complete and accurate.

After the Contractor Badge Request Information has been received, it will be entered into the Registration Authority's database. The Contractor Badges will be issued at Public Safety and can be picked up at the Public Safety Building (101 Doughty Street, Charleston, SC 29425) on the 3rd Business Day after it is entered into the database.

DOCUMENT 013100A - MUHA CONTRACTOR BADGE REQUEST

A CONTRACTOR PERFORMING WORK ON THE MUSC / MUHA CAMPUS IS RESPONSIBLE FOR:

- 1) Completing the following information for all employees of the contractor and/or subcontractors that will be on the MUSC / MUHA campus for project related work. A separate Contractor Badge Request must be filled out for each individual project on which a contractor/subcontractor employee is working as each project can have a different MUHA sponsor for these badges.
- 2) Submitting these forms to the MUSC Project Manager via email or at the MUSC Construction & Design Office (97 Jonathan Lucas St., Charleston, SC 29425). Contractor Badge Requests should be submitted at least 5 working days before construction start date.
- 3) Informing the MUSC Project Manager if any employee who has received a badge is no longer working on the MUSC / MUHA campus and returning the badge to the Public Safety Building (101 Doughty Street, Charleston, SC 29425).

COMPANY NAME: _____

FIRST NAME: _____

MIDDLE NAME: _____

LAST NAME: _____

JOB TITLE: _____

DATE OF BIRTH: _____

SS# _____

MUSC PROJ. MANAGER: Mr. Wade Lewis Gatlin, AIA

START DATE: _____

EXPECTED FINISH DATE: _____

Badges will not be issued unless ALL the above information is complete and accurate.

After the Contractor Badge Request Information has been received, it will be entered into the Registration Authority's database. The Contractor Badges will be issued at Public Safety and can be picked up at the Public Safety Building (101 Doughty Street, Charleston, SC 29425) on the 3rd Business Day after it is entered into the database.

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Photographic documentation.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to Owner.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

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

1. PDF electronic copy of schedule file, unless otherwise requested.

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

1. Submit a working PDF electronic copy of schedule, using software acceptable to Project Manager, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

C. Construction Schedule Updating Reports: Submit updated copy at Progress Meetings.

D. Daily Construction Reports: Submit at weekly intervals.

E. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

F. Digital Photographs: Submit unaltered, original, full-size image files with each Application for Payment.

1. Digital Camera: Minimum sensor resolution of 12 megapixels.
2. Identification: Name each image as follows: Project Number, followed by date, followed by sequential identifier keyed to accompanying Key Plan.

1.5 COORDINATION

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

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

1.6 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each separate area as a separate numbered activity for each main element of the Work. Provide division in schedule for each Phase of Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Architect.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

- a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
1. Temporary enclosure and space conditioning.
 2. Initial coordination drawings.
 3. Final coordination drawings.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.
- C. Schedule Preparation: Prepare a list of all activities required to complete the Work. Use earliest start dates and latest finish dates to include all float in work activities.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.
- E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. EOC permit requirements.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.
 20. Substantial Completions authorized.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At each Progress Meeting intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.2 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.

- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in file name for each image.
 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
1. Flag construction limits before taking construction photographs.
 2. Take photographs to show existing conditions adjacent to property before starting the Work.
 3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- G. Additional Photographs: Architect may request photographs in addition to periodic photographs specified.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 014240 – MUHA Documentation Standards.
 - 2. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 5. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 6. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to

submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 30 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number from Contractor's schedule.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in REVIT v2017.
 - c. Contractor shall execute a data licensing agreement, using a form acceptable to the Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

- a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 calendar days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 calendar days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item. Clearly identify all products and options proposed.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use MUSC Project Number, followed by Specification Section number followed by a decimal point and then a sequential number (e.g., 121001-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 121001-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Submittal file name.
 - b. MUSC Project Number.
 - c. MUSC Project name.
 - d. Date.
 - e. Name and address of Architect.
 - f. Name of Contractor.
 - g. Name of firm or entity that prepared submittal.
 - h. Names of subcontractor, manufacturer, and supplier.
 - i. Category and type of submittal.
 - j. Submittal purpose and description.
 - k. Specification Section number and title.
 - l. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - m. Drawing number and detail references, as appropriate.
 - n. Location(s) where product is to be installed, as appropriate.
 - o. Related physical samples submitted directly.
 - p. Indication of full or partial submittal.

- q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
- E. Options: Clearly identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- 1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
- 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:

- a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
- a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
- a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data..
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. MUSC Project Number.
 - b. MUSC Project name.
 - c. Generic description of Sample.
 - d. Product name and name of manufacturer.
 - e. Sample source.
 - f. Number and title of applicable Specification Section.
 - g. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- I. Material Safety Data Sheets: Comply with requirements specified in Section 016000 "Product Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Electronically submit certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit electronic record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Electronically submit statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Electronically submit statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Electronically submit statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Electronically submit statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Electronically submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Electronically submit reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Electronically submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Electronically submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Electronically submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- W. Field Test Reports: Electronically submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and electronically submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include MUSC Project name, MUSC Project number and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval. Stamp shall contain statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. South Carolina Department of Health and Environmental Control (DHEC) Inspections:
 - a. Above Ceiling Inspection.
 - b. Final Inspection.
 - 5. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
 - 1. Section 017701 "DHEC Construction Inspections" for final inspection.
 - 2. Section 095113 "Acoustical Panel Ceilings" for above ceiling inspections.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 REGULATORY REQUIREMENTS

- A. Copies of Regulations: Obtain copies of the applicable regulations and retain at Project site to be available for reference by parties who have a reasonable need.
- B. DHEC Requirements: Construction shall be in compliance with all requirements of the South Carolina Department of Health and Environmental Control, Division of Health Facilities Construction. Refer to Section 017701 – DHEC Construction Inspections.

1.5 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

- A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on re-testing and re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments,

judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.10 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

- d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
 7. For DHEC Inspections, notify Architect per requirements in 017701 "DHEC Construction Inspections"..
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified **special inspector** to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, **as indicated in Statement of Special Inspections attached to this Section**, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ABOVE-CEILING INSPECTIONS

- A. Prior to installation of ceiling systems, Architect and Engineer will conduct an above-ceiling completion inspection.
- B. Following inspection by Architect and Engineer, Contractor shall make required corrections prior to DHEC Above-Ceiling Inspection.

3.2 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.

3.3 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.4 FINAL CONSTRUCTION INSPECTIONS

- A. Architect and Engineer will conduct a Preliminary Inspection prior to Substantial Completion and a Substantial Completion Inspection on Substantial Completion date requested by Contractor.
- B. Following inspections by Architect and Engineer, Contractor shall make required corrections prior to DHEC Final Construction Inspection.
- C. Contractor shall be responsible for coordinating the completion of the Final Documentation as specified in Section 017701 - DHEC CONSTRUCTION INSPECTIONS.

END OF SECTION 014000

**OWNERS ACKNOWLEDGEMENT AND
IDENTIFICATION OF THE DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE**

Project: Storm Eye Institute Optical Shop Application No. _____

Project location: Storm Eye Institute, 167 Ashley Ave, Charleston, SC 29425

Project Owner: Medical University of South Carolina

Address: 97 Jonathan Lucas St., Charleston, SC 29425

Email: gatlin@musc.edu Phone: _____

I hereby acknowledge that I am the owner of the project referenced above and I have contracted with the design professional listed below to act as my agent in contracting and coordinating the required special inspections for the project.

Owners Signature Date

SC Registered Design Professional in Responsible Charge:

Name: Steven H. Coe, AIA License Number: SC 5573

Firm (optional): Rosenblum Coe Architects, Inc.

Phone: 843.577.6073 E-Mail Address: scoe@rosenblumcoe.com

This *Owners Acknowledgement and Identification of the Design Professional in Responsible Charge* is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the International Building Code, Chapter 17. It includes a Schedule of Special Inspection Services applicable to this project as well as the name of the Special Inspector(s) and the identity of other approved agencies that are to be retained for conducting these inspections.

The Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Design Professional in Responsible Charge and the Building Official. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Design Professional in Responsible Charge and the Building Official. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

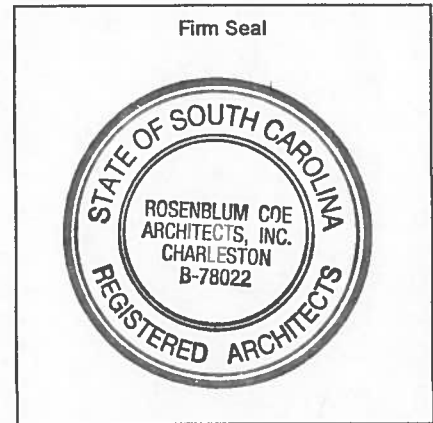
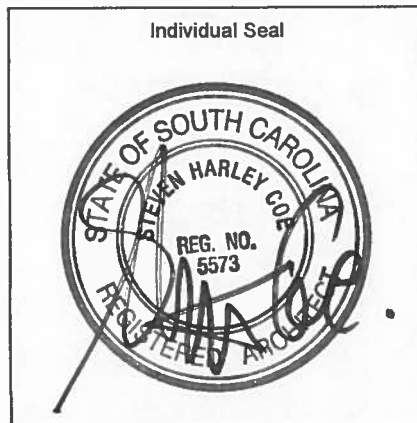
Design Professional in
Responsible Charge:

Signature Date

Reviewed by Code Official

Type or print name

Signature Date



Contractor Statement of Responsibility

Project Storm Eye Institute Optical Shop Application No. _____

IBC 1704.4 Contractor(s) responsibility: For the construction of a seismic-force-resisting system, designated seismic system, wind or seismic resisting component listed the Statement of Special Inspections.

Project Name: Storm Eye Institute Optical Shop

Project Address: 167 Ashley Ave, Charleston, SC 29425

Contractor's Name: _____

Contractors Phone Number: _____

Contractor's E-Mail Address: _____

Contractor's License Number: _____

Contractors Address: _____

1. I hereby acknowledge that I have read and am aware of the special requirements contained in the Statement of Special Inspections.

2. I hereby acknowledge that control will be exercised to obtain conformance with the construction documents reviewed by the Building Official.

3. The reports will be put in a 3 ring binder that is kept on the jobsite with the _____ Reviewed Plans/Documents. The documents in the binder shall be kept in the order referenced in the "Statement of Special Inspections"

4. Upon entry of the "Final Report of Inspections" the Special Inspection Binder shall be delivered to:

5. Control of this process will be exercised by:

Name: _____ Phone: _____ E-Mail Address: _____

Position in the Organization: _____

Signature

Date

Print Name

FINAL REPORT OF SPECIAL INSPECTIONS

Project: Storm Eye Institute Optical Shop Application No.: _____

Project location: 167 Ashley Avenue, Charleston, SC 29425

Project Owner: Medical University of South Carolina

Address: 97 Jonathan Lucas St., Charleston, SC 29425

SC Registered Design
Professional in Responsible Charge: Steven H. Coe, AIA

Firm (optional): Rosenblum Coe Architects, Inc.

License No.: SC _____ Phone: 843.577.6073 Fax: n/a

Address: 1643 Means St., Charleston, SC 29412

To the best of my information, knowledge, and belief, the Special Inspections and/or Testing required for this project, and designated for this Agent in the *Statement of Special Inspections* submitted for permit, have been completed in accordance with the contract documents.

Field reports submitted prior to this *Final Report of Inspections* form a basis for, and are to be considered an integral part of this Final Report. All discrepancies that were outstanding in all of the Field reports have been corrected.

Prepared by:

Steven H, Coe, AIA

Type or print name

Rosenblum Coe Architects, Inc.

Firm (optional)

Signature

Date

Individuals Seal

Firm Seal

STATEMENT "Schedule" OF SPECIAL INSPECTIONS

2015 IBC SECTION 1704.3

Project _____ Application No. _____

Design Professional _____ License No. _____

| Category | Item # | Verification & Inspection | Continuous | Periodic | Req. Y / N | Reference Standard or Compliance Document | IBC Reference | Special Inspector |
|---------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|------------|-------------------------------------------|-----------------------------------|-------------------|
| 1704.2.4 Report Requirement | | | | | | | | |
| Rep. | 1 | Special Inspector to keep record of special inspections and furnish inspection reports to the building official and to the Registered design professional in responsible charge. | -- | -- | Y | | 1704.2.4 | |
| 1704.2.5 Inspection of Fabricated Items | | | | | | | | |
| Fab. | 1 | Work done in fabricator shop requires inspector unless the fabricator is registered and approved according to IBC 1704.2.5.1. Where fabricator is approved, provide fabricator certification document. | -- | -- | N | | 1704.2.5 Document Required | |
| Fab. | 2 | At completion of fabrication, submit certificate of compliance to building official stating the work was performed in accordance with the approved construction documents. | -- | -- | N | | 1704.2.5.1 Document Required | |
| 1704.3 Statement of Special Inspections | | | | | | | | |
| Rep. | | A registered design professional in responsible charge shall prepare a statement of special inspections | -- | -- | Y | | 1704.3 (THIS DOCUMENT) | |
| 1704.4 Contractor Responsibility | | | | | | | | |
| Rep. | | Each contractor responsible for the construction of a main wind- or seismic force resisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections shall submit a written statement of responsibility. | -- | -- | N | | 1704.4 (Page 4 Document required) | |
| 1704.5 Submittals to the Building Official | | | | | | | | |
| Rep. | | In addition to the submittal reports of special inspections and tests in accordance with Section 1704.2.4, reports and certificates shall be submitted by the owner or owner's authorized agent to the building official for each of the following. | -- | -- | Y | | 1704.5 | |
| Rep. | 1 | Certificates of compliance for the fabrication of structural, load-bearing or lateral load-resisting members or assemblies on the premises of a registered and approval fabricator in accordance with Section 1704.2.5.1 | -- | -- | N | Section 1704.2.5.1 (Fabricator) | 1704.5 | |
| Rep. | 2 | Certificates of compliance for the seismic qualification of nonstructural components, supports and attachments in accordance with Section 1705.13.2 | -- | -- | Y | Section 1705.13.2 | 1704.5 | |

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| Rep. | 3 | Certificates of compliance for designated seismic systems in accordance with Section 1705.1.3.3 | -- | -- | N | Section 1705.1.3.3 and 1704.3.2 | 1704.5 and 1704.3.2 | |
| Rep. | 4 | Reports of preconstruction tests for shotcrete in accordance with Section 1908.5 | -- | -- | N | Section 1908.5 | 1704.5 | |
| Rep. | 5 | Certificates of compliance for open web steel joist and joist girders in accordance with Section 2207.5 | -- | -- | N | Section 2207.5 | 1704.5 | |
| Rep. | 6 | Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.5.4. of ACI 318 for reinforcing bar in concrete complying with a standard other than ASTM A 706 that are to welded | -- | -- | N | AWS D1.4 Section Section 26.5.4 of ACI 318 ASTM A 706 | 1704.5 | |
| Rep. | 7 | Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A 615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category B, C, D, E, or F | -- | -- | N | Section 20.2.2.5 of ACI 318 ASTM A 615 | 1704.5 | |
| 1704.6 Structural Observation | | | | | | | | |
| Rep. | | The owner shall employ a registered design professional to perform structural observation. Prior to commencement of observation, the structural observer shall submit to the building official a written statement identifying frequency and extent of structural observations. | -- | -- | N | Seismic Design Category D, E or F only | 1704.6 | |
| 1705.2.1 Steel Construction Inspection | | | | | | | | |
| Stl. | 1 | Structural Steel shall be in accordance with the quality assurance inspection requirements of AISC 360 | -- | -- | N | AISC 360 | 1705.2.1 | |
| 1705 Steel Construction other than Structural Steel Inspection | | | | | | | | |
| Stl. | 1 | Material verification of high-strength bolts, nuts and washers | -- | -- | N | ASTM Standards | 1705.2 | |
| Stl. | 1a | Identification markings to conform to ASTM standards specified in the approved construction documents | -- | -- | N | AISC 360, Section A3.3 and applicable ASTM material standards | 1705.2 | |
| Stl. | 1b | Manufacturer's certificate test reports | -- | -- | N | | 1705.2 | |
| Stl. | 2 | Inspection of welding | -- | -- | N | | | |
| | 2a. | Cold-formed steel deck | -- | -- | N | | | |
| Stl. (str) | 2a (1) | Floor and roof deck welds | -- | -- | N | AWS D1.3 | 1705.3 | |

| Category | Item # | Verification & Inspection | Continuous | Periodic | Req Y / N | Reference Standard or Compliance Document | IBC Reference | Agent |
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| | 2b | Reinforcing steel | -- | -- | N | | 1705.3 | |
| Stl. (reinf) | 2b (1) | Verification of weldability of reinforcing steel other than ASTM A 706 | -- | -- | N | AWDS D1.4 ACI 318: 3.5.2 | 1705.2 | |
| Stl. (reinf) | 2b (2) | Reinforcing steel-resisting flexural and axial forces | -- | -- | N | AWDS D1.4 ACI 318: 3.5.2 | 1705.2 | |
| Stl. (reinf) | 2b (3) | Shear reinforcement | -- | -- | N | AWDS D1.4 ACI 318: 3.5.2 | 1705.2 | |
| Stl. (reinf) | 2b (4) | Other reinforcing steel | -- | -- | N | AWDS D1.4 ACI 318: 3.5.2 | 1705.2 | |
| 1705.2.3 Inspection of Open-web Steel Joist and Joist Girders | | | | | | | | |
| Stl. | 1 | Installation of open-web steel joist and joist girders | -- | -- | N | SJI specification listed in Section 2207.1 | Table 1705.2.3 | |
| Stl. | 1a | End connections – welding or bolted | -- | -- | N | | Table 1705.2.3 | |
| Stl. | 1b | Bridging – horizontal or diagonal | -- | -- | N | SJI specification listed in Section 2207.1 | Table 1705.2.3 | |
| Stl. | 1b (1) | Standard bridging | -- | -- | N | | Table 1705.2.3 | |
| Stl. | 1b (2) | Bridging that differs from the SJI specifications listed in Section 2207.1 | -- | -- | N | | Table 1705.2.3 | |
| 1705.3 Concrete Construction | | | | | | | | |
| Conc. | 1 | Inspection of reinforcing steel including prestressing tendons, and placement | -- | -- | N | ACI 318 Ch. 20, 25.2, 25.3, 26.5.1-26.5.3, 35 and IBC 1905 | 1705.3 | |
| Conc. | 2 | Reinforcing bar welding | -- | -- | N | | Table 1705.3 | |
| Conc. | 2a | Verify weldability of reinforcing bars other than ASTM A 706 | -- | -- | N | IBC 1905 AWS D1.4 ACI 318: 26.5.4 | Table 1705.3 | |
| Conc. | 2b | Inspect single-pass welds, maximum 5/6" | -- | -- | N | | Table 1705.3 | |
| Conc. | 2c | Inspect all other welds | -- | -- | N | | Table 1705.3 | |
| Conc. | 3 | Inspection of anchors cast in concrete | -- | -- | N | IBC 1905 ACI 318: 17.8.2 | Table 1705.3 | |
| Conc. | 4 | Inspection of anchors post-installed in hardened concrete members | -- | -- | N | | | |
| Conc. | 4a | Adhesive anchors installed in horizontally or upwardly inclined | -- | -- | N | ACI 318: 17.8.2.4 | Table 1705.3 | |
| Conc. | 4b | Mechanical anchors and adhesive anchors not defined in 4a | -- | -- | N | ACI 381: 17.8.2 | Table 1705.3 | |
| Conc. | 5 | Verifying use of required design mix | -- | -- | N | ACI 318: Ch. 19, 26.4.3, 26.4.4 | 1904.1, 1904.2, 1908.2, 1908.3, Table 1705.3 | |

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| Conc. | 6 | Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete | -- | -- | N | ASTM C172 ASTM C31 ACI 318: 26.4.5, 26.12 | 1908.10 & Table 1705.3 | |
| Conc. | 7 | Inspection of concrete and shotcrete placement for proper application techniques | -- | -- | N | ACI 318: 26.4.5 | 1908.6, 1908.7, 1908.8, Table 1705.3 | |
| Conc. | 8 | Verify maintenance of specified curing temperature and techniques | -- | -- | N | ACI 318: 26.4.7 – 26.4.9 | 1908.9 & Table 1705.3 | |
| Conc. | 9 | Inspection of pre-stressed concrete | -- | -- | N | | | |
| Conc. | 9a | Application of pre-stressing forces | -- | -- | N | ACI 318: 26.9.2.1 ACI 318: 26.9.2.3 | Table 1705.3 | |
| Conc. | 9b | Grouting of bonded pre-stressing tendon | -- | -- | N | | Table 1705.3 | |
| Conc. | 10 | Inspect erection of precast concrete members | -- | -- | N | ACI 318: Ch. 26.8 | Table 1705.3 | |
| Conc. | 11 | Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs | -- | -- | N | ACI 318: 26.10.2 | Table 1705.3 | |
| Conc. | 12 | Inspect formwork for shape, location and dimensions of the concrete member being formed | -- | -- | N | ACI 318: 26.10.1(b) | Table 1705.3 | |
| 1705.4 Masonry Construction | | | | | | | | |
| Mas. | | Masonry construction shall be inspected and verified per standards | -- | -- | N | TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE 6 | 1705.4 | |
| Mas. | 1 | Empirically design masonry, glass unit masonry and masonry veneer in Risk Category IV | -- | -- | N | Section 2109, 2110 or Chapter 14, Section 1604.5, shall comply with TMS 402/ACI 530/ ASCE 5 Level B Quality Assurance | 1705.4.1 | |
| Mas. | 2 | Vertical masonry foundation elements | -- | -- | N | IBC Section 1705.4 | 1705.4.2 | |
| 1705.5 Wood Construction | | | | | | | | |
| Wd | 1 | High-Load Diaphragms | -- | -- | N | IBC Sec. 2306.2, Sec 1704.2, approved construction drawings | 1705.5.1 | |
| Wd | 2 | Metal-plate-connected wood trusses spanning 60 feet or greater | -- | -- | N | Approved truss submittal package (bracing) | 1705.5.2 | |
| 1705.6 Soils | | | | | | | | |
| Soil | 1 | Verify materials below shallow foundations are adequate to achieve the design bearing capacity | -- | -- | N | | Table 1705.6 | |
| Soil | 2 | Verify excavations are extended to proper depth and have reached proper material | -- | -- | N | | Table 1705.6 | |
| Soil | 3 | Perform classification and testing of compacted fill materials | -- | -- | N | | Table 1705.6 | |
| Soil | 4 | Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill | -- | -- | N | | Table 1705.6 | |

| Category | Item # | Verification & Inspection | Continuous | Periodic | Req Y / N | Reference Standard or Compliance Document | IBC Reference | Agent |
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| Soil | 5 | Prior to placement of compacted fill, observe sub-grade and verify that site has been prepared properly | -- | -- | N | | Table 1705.6 | |
| 1705.7 Driven Deep Foundation | | | | | | | | |
| Drv | 1 | Verify element materials, sizes and lengths comply with the requirements | -- | -- | N | | Table 1705.7 | |
| Drv | 2 | Determine capacities of test elements and conduct additional load tests, as required | -- | -- | N | | Table 1705.7 | |
| Drv | 3 | Inspect driving operations and maintain complete and accurate records for each element | -- | -- | N | | Table 1705.7 | |
| Drv | 4 | Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element | -- | -- | N | | Table 1705.7 | |
| Drv | 5 | For steel elements, perform additional inspections in accordance with Section 1705.2 | -- | -- | N | | Sec. 1705.7 & Table 1705.7 | |
| Drv | 6 | For concrete elements and concrete filled elements, perform additional inspections in accordance with Section 1705.3 | -- | -- | N | | Sec. 1705.7 & Table 1705.7 | |
| Drv | 7 | For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge | -- | -- | N | | Table 1705.7 | |
| 1705.8 Cast-In-Place Deep Foundation | | | | | | | | |
| CIP | 1 | Inspect drilling operations and maintain complete and accurate records for each element | -- | -- | N | | Table 1705.8 | |
| CIP | 2 | Verify placement locations and plumbness; confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end bearing strata capacity. Record concrete or grout volumes | -- | -- | N | | Table 1705.8 | |
| CIP | 3 | For concrete elements, perform additional inspections in accordance with Section 1705.3 | -- | -- | N | | Sec. 1705.3 & Table 1705.8 | |
| 1705.9 Helical Pile Foundations | | | | | | | | |
| HPF | 1 | Installation of helical pile foundations | -- | -- | N | Approved Geotechnical report and registered design professional | 1705.9 | |
| 1705.10 Special Inspections for Fabricated Items | | | | | | | | |
| Fab | | Special inspections of fabricated items shall be performed in accordance with Section 1704.2.5 | -- | -- | N | | 1705.10 | |
| 1705.11 Special Inspections for Wind Resistance | | | | | | | | |
| Wind | | Wind Requirements for buildings and structures per 1705.11 | -- | -- | N | | 1705.11 | |
| Wind | 1 | Structural Wood | -- | -- | N | | 1705.11.1 | |
| Wind | 2 | Cold-formed steel light-frame construction | -- | -- | | | 1705.11.2 | |

| Category | Item # | Verification & Inspection | Continuous | Periodic | Req Y / N | Reference Standard or Compliance Document | IBC Reference | Agent |
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| Wind | 3 | Wind-resisting components. 1. Roof covering, roof deck and roof framing connections 2. Exterior wall covering and wall connections to roof and floor diaphragms and framing | -- | -- | N | | 1705.11.3 | |
| 1705.12 Special Inspection for Seismic Resistance | | | | | | | | |
| Seis | 1 | Structural Steel seismic resistance shall be in accordance with Section 1705.12.1.1 or 1705.12.1.2 as applicable | -- | -- | N | Section 1705.12.1.1 Section 1705.12.1.2 | 1705.12.1 | |
| Seis | 1a | Seismic force-resisting systems of structural steel in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance of requirements of AISC 341. | -- | -- | N | AISC 341 | 1705.12.1.1 | |
| Seis | 1b | Structural steel elements in the seismic force resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F other than those covered in Section 1705.12.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341 | -- | -- | N | Section 1705.12.1.1 AISC 341 | 1705.12.1.2 | |
| Seis | 2 | Structural wood for the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F | -- | -- | N | | 1705.12.2 | |
| Seis | 2a | Structural wood field gluing operations of elements of seismic force-resisting system | -- | -- | N | | 1705.12.2 | |
| Seis | 2b | Structural wood fastening for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold downs | -- | -- | N | | 1705.12.2 | |
| Seis | 3 | Cold-formed steel light-frame construction for seismic force resisting systems of structures assigned to Seismic Design Category C, D, E or F | -- | -- | N | | 1705.12.3 | |
| Seis | 3a | For welding operations of elements of the seismic force resisting system | -- | -- | N | | 1705.12.3 | |
| Seis | 3b | For screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs | -- | -- | N | | 1705.12.3 | |
| Seis | 4 | Designated seismic system verifications for structures assigned to Seismic Design Category C, D, E or F, the special inspector shall examine designated seismic systems requiring seismic qualification in accordance with Section 13.2.2 of ASCE 7 and verify that the label, anchorage and mounting conform to the certificate of compliance | -- | -- | N | Section 13.2.2 ASCE 7 | 1705.12.4 | |

| Category | Item # | Verification & Inspection | Continuous | Periodic | Req Y / N | Reference Standard or Compliance Document | IBC Reference | Agent |
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| Seis | 5 | Architectural Components in D, E, or F | -- | -- | Y | D, E, F | 1705.12.5 | |
| Seis | 5.1 | Access Floors in D, E, or F | -- | -- | N | D, E, F | 1705.12.5.1 | |
| Seis | 6 | Plumbing, Mechanical and Electrical Components | | | Y | | 1705.12.6 | |
| Seis | 6a | Anchorage of electrical equipment for emergency or standby power systems, in C, D, E or F | -- | -- | Y | | 1705.12.6 | |
| Seis | 6b | Anchorage of other electrical equipment in E or F | -- | -- | Y | | 1705.12.6 | |
| Seis | 6c | Installation and anchoring of piping systems designed to carry hazardous materials and associated mechanical units in C, D, E or F | -- | -- | N | | 1705.12.6 | |
| Seis | 6d | Installation of HVAC ductwork that will carry hazardous materials in C, D, E or F | -- | -- | N | | 1705.12.6 | |
| Seis | 6e | Installation of vibration isolation systems with clearance less than 0.25 inches between equipment support frame and restraint where indicated on construction documents in C, D, E or F | -- | -- | N | | 1705.12.6 | |
| Seis | 7 | Storage Rack during anchoring storage racks 8 feet or greater in height in D, E or F | -- | -- | N | | 1705.12.7 | |
| Seis | 8 | Seismic Isolation System | -- | -- | Y | | 1705.12.8 | |
| Seis | 9 | Cold-formed steel special bolted moment frames in the seismic force-resisting systems of structures assigned to seismic Design Category D, E or F | -- | -- | N | | 1705.12.9 | |
| 1705.13 Testing for Seismic Resistance | | | | | | | | |
| Test | 1 | Structural Steel | -- | -- | N | Section 1705.13.1.1 Section 1705.13.1.2 | 1705.13.1 | |
| Test | 2 | Seismic force-resisting systems | -- | -- | N | AISC 341 | 1706.13.1.1 | |
| Test | 3 | Structural steel elements | -- | -- | N | AISC 341 | 1705.13.1.2 | |
| Test | 4 | Seismic certification of nonstructural components and designated seismic systems | -- | -- | N | Per the registered design professionals requirements on the construction documents. Sec. 13.2 of ASCE 7 | 1705.13.2 and 1705.13.3 | |
| Test | 5 | Seismically isolated structures | -- | -- | N | Sec. 17.8 of ASCE 7 | 1705.13.4 | |
| 1705.14 Sprayed Fire Resistant Materials | | | | | | | | |
| FRM | 1 | Physical and visual tests: 1. Condition of substrates 2. Thickness of application 3. Density in pounds per cubic foot 4. Bond strength adhesion/cohesion 5. Condition of finished application | -- | -- | N | | 1705.14.1 | |
| FRM | 2 | Structural member surface conditions in conformance with approved fire-resistance design and manufacturers instructions | -- | -- | N | | 1705.14.2 | |

| Category | Item # | Verification & Inspection | Continuous | Periodic | Req Y / N | Reference Standard or Compliance Document | IBC Reference | Agent |
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| FRM | 3 | Application per manufacturers instructions | -- | -- | N | | 1705.14.3 | |
| FRM | 4 | Thickness | -- | -- | N | ASTM E605 | 1705.14.4 | |
| FRM | 4a | Minimum allowable thickness | -- | -- | N | ASTM E605 | 1705.14.4.1 | |
| FRM | 4b | Floor, roof and wall assemblies. Not less than four measurements for each 1,000 sq. ft. of the sprayed area in each story or portion thereof | -- | -- | N | ASTM E605 | 1705.14.4.2 | |
| FRM | 4c | Cellular decks. Thickness measurements shall be selected from a square area, 12 inches x 12 inches in size. A minimum of four measurements shall be made, located symmetrically within the square area | -- | -- | N | ASTM E605 | 1705.14.4.3 | |
| FRM | 4d | Fluted decks. Thickness measurements shall be selected from a square area, 12 inches x 12 inches in size. A minimum of four measurements shall be made, located symmetrically within the square area, including one of each of the following: valley, crest and sides | -- | -- | N | ASTM E605 | 1705.14.4.4 | |
| FRM | 4e | Structural members. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor. | -- | -- | N | ASTM E605 | 1705.14.4.5 | |
| FRM | 4f | Beams and girders. Thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch length | -- | -- | N | ASTM E605 | 1705.14.4.6 | |
| FRM | 4g | Joists and trusses. Thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch length | -- | -- | N | ASTM E605 | 1705.14.4.7 | |
| FRM | 4h | Wide-flanged columns. Thickness measurements shall be made at twelve locations around the column at each end of a 12-inch length | -- | -- | N | ASTM E605 | 1705.14.4.8 | |
| FRM | 4i | Hollow structural section and pipe columns. Thickness measurements shall be made at minimum of four locations around the column at each end of a 12-inch length | -- | -- | N | ASTM E605 | 1705.14.4.9 | |
| FRM | 5 | Density | -- | -- | N | ASTM E605 | 1705.14.4.9 | |
| FRM | 5a | From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet or portion thereof of the sprayed area in each story | -- | -- | N | ASTM E605 | 1705.14.5 | |
| FRM | 5b | From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet of floor area or portion thereof in each story | -- | -- | N | ASTM E605 | 1705.14.5 | |
| FRM | 6 | Bond strength (cohesive/adhesive) | -- | -- | N | ASTM E736 | 1705.14.6 | |
| FRM | 6a | Floor, roof and wall assemblies. Not less than one sample from each floor, roof and wall assembly for each 2,500 square feet of the sprayed area in each story or portion thereof | -- | -- | N | ASTM E736 | 1705.14.6.1 | |

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| FRM | 6b | Structural members. Not less than one sample from each beam, girders, trusses, columns and other structural members for each type of structural member for each 2,500 square feet of the floor area in each story or portion thereof. | -- | -- | N | ASTM E736 | 1705.14.6.2 | |
| FRM | 6c | Primer, paint and encapsulate bond tests | -- | -- | N | ASTM E736 | 1705.14.6.3 | |
| 1705.15 Mastic and Intumescent Fire Resistant Coatings | | | | | | | | |
| FRC | 1 | Verification and inspection of fire-resistance design designated in construction documents | -- | -- | N | AWCI 12-B | 1705.15 | |
| 1705.16 Exterior Insulation and Finish Systems (EIFS) | | | | | | | | |
| EIFS | 1 | Field application (Special inspection not required where EIFS is installed over water resistant barrier with drainage system or over masonry or concrete) | -- | -- | N | | 1705.16 | |
| EIFS | 2 | Water-Resistive Barrier Coating | -- | -- | N | ASTM E2570 | 1705.16 | |
| 1705.17 Fire-Resistant Penetrations and Joint | | | | | | | | |
| FRPJ | 1 | Verifications in high-rise buildings or buildings assigned to Risk Category III or IV | -- | -- | N | | 1705.17 | |
| FRPJ | 1a | Penetration Firestops | -- | -- | Y | ASTM E2174 | 1705.17.1 | |
| FRPJ | 1b | Fire-Resistant Joint System | -- | -- | Y | ASTM E2393 | 1705.17.2 | |
| 1705.18 Smoke Control | | | | | | | | |
| Smoke | 1 | Smoke Control Inspection prior to concealment | -- | -- | N | | 1705.18.1(1) | |
| Smoke | 2 | Smoke Control Testing prior to occupancy | -- | -- | N | | 1705.18.1(2) | |
| Smoke | 3 | Qualifications of Inspector | -- | -- | N | | 1705.18.2 | |

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

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

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

1.4 ABBREVIATIONS AND ACRONYMS

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

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

| | | |
|--------|-------------------------------------------------------------------------------------------------|----------------------------------|
| AABC | Associated Air Balance Council www.aabc.com | (202) 737-0202 |
| AAMA | American Architectural Manufacturers Association www.aamanet.org | (847) 303-5664 |
| AASHTO | American Association of State Highway and Transportation Officials www.transportation.org | (202) 624-5800 |
| AATCC | American Association of Textile Chemists and Colorists www.aatcc.org | (919) 549-8141 |
| ABMA | American Bearing Manufacturers Association www.americanbearings.org | (202) 367-1155 |
| ACI | American Concrete Institute (Formerly: ACI International) www.concrete.org | (248) 848-3700 |
| ACPA | American Concrete Pipe Association www.concrete-pipe.org | (972) 506-7216 |
| AEIC | Association of Edison Illuminating Companies, Inc. (The) www.aeic.org | (205) 257-2530 |
| AF&PA | American Forest & Paper Association www.afandpa.org | (800) 878-8878 (202) 463-2700 |
| AGA | American Gas Association www.aga.org | (202) 824-7000 |
| AHAM | Association of Home Appliance Manufacturers www.aham.org | (202) 872-5955 |
| AHRI | Air-Conditioning, Heating, and Refrigeration Institute (The) | (703) 524-8800 |

www.ahrinet.org

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| AIA | American Institute of Architects (The) www.aia.org | (800) 242-3837 (202) 626-7300 |
| AISC | American Institute of Steel Construction www.aisc.org | (800) 644-2400 (312) 670-2400 |
| AISI | American Iron and Steel Institute www.steel.org | (202) 452-7100 |
| AMCA | Air Movement and Control Association International, Inc. www.amca.org | (847) 394-0150 |
| ANSI | American National Standards Institute www.ansi.org | (202) 293-8020 |
| APA | APA - The Engineered Wood Association www.apawood.org | (253) 565-6600 |
| APA | Architectural Precast Association www.archprecast.org | (239) 454-6989 |
| API | American Petroleum Institute www.api.org | (202) 682-8000 |
| ARI | Air-Conditioning & Refrigeration Institute (See AHRI) | |
| ARI | American Refrigeration Institute (See AHRI) | |
| ARMA | Asphalt Roofing Manufacturers Association www.asphaltroofing.org | (202) 207-0917 |
| ASCE | American Society of Civil Engineers www.asce.org | (800) 548-2723 (703) 295-6300 |
| ASCE/SEI | American Society of Civil Engineers/Structural Engineering Institute (See ASCE) | |
| ASHRAE | American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org | (800) 527-4723 (404) 636-8400 |
| ASME | ASME International | (800) 843-2763 |

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| | (American Society of Mechanical Engineers) www.asme.org | (973) 882-1170 |
| ASSE | American Society of Safety Engineers (The) www.asse.org | (847) 699-2929 |
| ASSE | American Society of Sanitary Engineering www.asse-plumbing.org | (440) 835-3040 |
| ASTM | ASTM International (American Society for Testing and Materials International) www.astm.org | (610) 832-9500 |
| ATIS | Alliance for Telecommunications Industry Solutions www.atis.org | (202) 628-6380 |
| AWI | Architectural Woodwork Institute www.awinet.org | (571) 323-3636 |
| AWPA | American Wood Protection Association (Formerly: American Wood-Preservers' Association) www.awpa.com | (205) 733-4077 |
| AWS | American Welding Society www.aws.org | (800) 443-9353 (305) 443-9353 |
| AWWA | American Water Works Association www.awwa.org | (800) 926-7337 (303) 794-7711 |
| BHMA | Builders Hardware Manufacturers Association www.buildershardware.com | (212) 297-2122 |
| BIA | Brick Industry Association (The) www.gobrick.com | (703) 620-0010 |
| BICSI | BICSI, Inc. www.bicsi.org | (800) 242-7405 (813) 979-1991 |
| BIFMA | BIFMA International (Business and Institutional Furniture Manufacturer's Association) www.bifma.com | (616) 285-3963 |
| BISSC | Baking Industry Sanitation Standards Committee www.bissc.org | (866) 342-4772 |
| BOCA | BOCA (Building Officials and Code Administrators International Inc.) (See ICC) | |

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| CDA | Copper Development Association www.copper.org | (800) 232-3282 (212) 251-7200 |
| CEA | Consumer Electronics Association www.ce.org | (866) 858-1555 (703) 907-7600 |
| CFFA | Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com | (216) 241-7333 |
| CFSEI | Cold-Formed Steel Engineers Institute www.cfsei.org | (866) 465-4732 (202) 263-4488 |
| CGA | Compressed Gas Association www.cganet.com | (703) 788-2700 |
| CIMA | Cellulose Insulation Manufacturers Association www.cellulose.org | (888) 881-2462 (937) 222-2462 |
| CISCA | Ceilings & Interior Systems Construction Association www.cisca.org | (630) 584-1919 |
| CISPI | Cast Iron Soil Pipe Institute www.cispi.org | (404) 622-0073 |
| CLFMI | Chain Link Fence Manufacturers Institute www.chainlinkinfo.org | (301) 596-2583 |
| CPA | Composite Panel Association www.pbmdf.com | (703) 724-1128 |
| CRI | Carpet and Rug Institute (The) www.carpet-rug.org | (706) 278-3176 |
| CRRC | Cool Roof Rating Council www.coolroofs.org | (866) 465-2523 (510) 485-7175 |
| CRSI | Concrete Reinforcing Steel Institute www.crsi.org | (800) 328-6306 (847) 517-1200 |
| CSI | Construction Specifications Institute (The) www.csinet.org | (800) 689-2900 (703) 684-0300 |

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| CTI | Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org | (281) 583-4087 |
| CWC | Composite Wood Council (See CPA) | |
| DASMA | Door and Access Systems Manufacturers Association www.dasma.com | (216) 241-7333 |
| DHEC | Department of Health & Environmental Control (See SCDHEC under government agency section) | |
| DHI | Door and Hardware Institute www.dhi.org | (703) 222-2010 |
| ECA | Electronic Components Association www.ec-central.org | (703) 907-8024 |
| ECAMA | Electronic Components Assemblies & Materials Association (See ECA) | |
| EIA | Electronic Industries Alliance (See TIA) | |
| EIMA | EIFS Industry Members Association www.eima.com | (800) 294-3462 (703) 538-1616 |
| EJMA | Expansion Joint Manufacturers Association, Inc. www.ejma.org | (914) 332-0040 |
| ESD | ESD Association (Electrostatic Discharge Association) www.esda.org | (315) 339-6937 |
| ESTA | Entertainment Services and Technology Association (See PLASA) | |
| EVO | Efficiency Valuation Organization www.evo-world.org | (415) 367-3643 44 20 88 167 857 |
| FM Approvals | FM Approvals LLC www.fmglobal.com | (781) 762-4300 |
| FM Global | FM Global (Formerly: FMG - FM Global) | (401) 275-3000 |

www.fmglobal.com

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| FSA | Fluid Sealing Association www.fluidsealing.com | (610) 971-4850 |
| FSC | Forest Stewardship Council U.S. www.fscus.org | (612) 353-4511 |
| GA | Gypsum Association www.gypsum.org | (301) 277-8686 |
| GANA | Glass Association of North America www.glasswebsite.com | (785) 271-0208 |
| GS | Green Seal www.greenseal.org | (202) 872-6400 |
| HI | Hydraulic Institute www.pumps.org | (973) 267-9700 |
| HI/GAMA | Hydronics Institute/Gas Appliance Manufacturers Association (See AHRI) | |
| HMMA | Hollow Metal Manufacturers Association (See NAAMM) | |
| HPVA | Hardwood Plywood & Veneer Association www.hpva.org | (703) 435-2900 |
| HPW | H. P. White Laboratory, Inc. www.hpwhite.com | (410) 838-6550 |
| IAPSC | International Association of Professional Security Consultants www.iapsc.org | (415) 536-0288 |
| IAS | International Approval Services (See CSA) | |
| ICBO | International Conference of Building Officials (See ICC) | |
| ICC | International Code Council www.iccsafe.org | (888) 422-7233 (202) 370-1800 |
| ICEA | Insulated Cable Engineers Association, Inc. www.icea.net | (770) 830-0369 |
| ICPA | International Cast Polymer Alliance www.icpa-hq.org | (703) 525-0511 |
| ICRI | International Concrete Repair Institute, Inc. www.icri.org | (847) 827-0830 |

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| IEC | International Electrotechnical Commission www.iec.ch | 41 22 919 02 11 |
| IEEE | Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org | (212) 419-7900 |
| IES | Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America) www.ies.org | (212) 248-5000 |
| IESNA | Illuminating Engineering Society of North America (See IES) | |
| IEST | Institute of Environmental Sciences and Technology www.iest.org | (847) 981-0100 |
| IGMA | Insulating Glass Manufacturers Alliance www.igmaonline.org | (613) 233-1510 |
| IGSHPA | International Ground Source Heat Pump Association www.igshpa.okstate.edu | (405) 744-5175 |
| ILI | Indiana Limestone Institute of America, Inc. www.iliai.com | (812) 275-4426 |
| ILSM | Interim Life Safety Measures www.safetymanagementgroup.com | (800) 435-8850 |
| Intertek | Intertek Group (Formerly: ETL SEMCO; Intertek Testing Service NA) www.intertek.com | (800) 967-5352 |
| ISA | International Society of Automation (The) (Formerly: Instrumentation, Systems, and Automation Society) www.isa.org | (919) 549-8411 |
| ISAS | Instrumentation, Systems, and Automation Society (The) (See ISA) | |
| ISFA | International Surface Fabricators Association (Formerly: International Solid Surface Fabricators Association) www.isfanow.org | (877) 464-7732 (801) 341-7360 |
| ISO | International Organization for Standardization www.iso.org | 41 22 749 01 11 |
| ISSFA | International Solid Surface Fabricators Association (See ISFA) | |
| ITU | International Telecommunication Union www.itu.int/home | 41 22 730 51 11 |
| JCAHO | Joint Commission on Accreditation of Healthcare Organizations www.jointcommission.org (see TJC for “The Joint Commission” which is new designation for this agency.) | (630) 792-3007 |

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| KCMA | Kitchen Cabinet Manufacturers Association www.kcma.org | (703) 264-1690 |
| LMA | Laminating Materials Association (See CPA) | |
| LPI | Lightning Protection Institute www.lightning.org | (800) 488-6864 |
| MBMA | Metal Building Manufacturers Association www.mbma.com | (216) 241-7333 |
| MCA | Metal Construction Association www.metalconstruction.org | (847) 375-4718 |
| MFMA | Maple Flooring Manufacturers Association, Inc. www.maplefloor.org | (888) 480-9138 |
| MFMA | Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org | (312) 644-6610 |
| MHIA | Material Handling Industry of America www.mhia.org | (800) 345-1815 (704) 676-1190 |
| MIA | Marble Institute of America www.marble-institute.com | (440) 250-9222 |
| MMPA | Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association) www.wmmpa.com | (800) 550-7889 (530) 661-9591 |
| MPI | Master Painters Institute www.paintinfo.com | (888) 674-8937 (604) 298-7578 |
| MSS | Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.org | (703) 281-6613 |
| NAAMM | National Association of Architectural Metal Manufacturers www.naamm.org | (630) 942-6591 |
| NACE | NACE International (National Association of Corrosion Engineers International) www.nace.org | (800) 797-6223 (281) 228-6200 |
| NADCA | National Air Duct Cleaners Association www.nadca.com | (202) 737-2926 |
| NAIMA | North American Insulation Manufacturers Association www.naima.org | (703) 684-0084 |
| NBGQA | National Building Granite Quarries Association, Inc. www.nbgqa.com | (800) 557-2848 |

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| NCMA | National Concrete Masonry Association www.ncma.org | (703) 713-1900 |
| NEBB | National Environmental Balancing Bureau www.nebb.org | (301) 977-3698 |
| NECA | National Electrical Contractors Association www.necanet.org | (301) 657-3110 |
| NeLMA | Northeastern Lumber Manufacturers Association www.nelma.org | (207) 829-6901 |
| NEMA | National Electrical Manufacturers Association www.nema.org | (703) 841-3200 |
| NETA | InterNational Electrical Testing Association www.netaworld.org | (888) 300-6382 (269) 488-6382 |
| NFHS | National Federation of State High School Associations www.nfhs.org | (317) 972-6900 |
| NFPA | NFPA (National Fire Protection Association) www.nfpa.org | (800) 344-3555 (617) 770-3000 |
| NFPA | NFPA International (See NFPA) | |
| NFRC | National Fenestration Rating Council www.nfrc.org | (301) 589-1776 |
| NHLA | National Hardwood Lumber Association www.nhla.com | (800) 933-0318 (901) 377-1818 |
| NLGA | National Lumber Grades Authority www.nlga.org | (604) 524-2393 |
| NOFMA | National Oak Flooring Manufacturers Association (See NWFA) | |
| NOMMA | National Ornamental & Miscellaneous Metals Association www.nomma.org | (888) 516-8585 |
| NRCA | National Roofing Contractors Association www.nrca.net | (800) 323-9545 (847) 299-9070 |
| NRMCA | National Ready Mixed Concrete Association www.nrmca.org | (888) 846-7622 (301) 587-1400 |
| NSF | NSF International (National Sanitation Foundation International) www.nsf.org | (800) 673-6275 (734) 769-8010 |
| NSPE | National Society of Professional Engineers www.nspe.org | (703) 684-2800 |

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| NSSGA | National Stone, Sand & Gravel Association www.nssga.org | (800) 342-1415 (703) 525-8788 |
| NTMA | National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com | (800) 323-9736 |
| NWFA | National Wood Flooring Association www.nwfa.org | (800) 422-4556 (636) 519-9663 |
| PCI | Precast/Prestressed Concrete Institute www.pci.org | (312) 786-0300 |
| PDI | Plumbing & Drainage Institute www.pdionline.org | (800) 589-8956 (978) 557-0720 |
| PLASA | PLASA (Formerly: ESTA - Entertainment Services and Technology Association) www.plasa.org | (212) 244-1505 |
| RCSC | Research Council on Structural Connections www.boltcouncil.org | |
| RFCI | Resilient Floor Covering Institute www.rfci.com | (706) 882-3833 |
| RIS | Redwood Inspection Service www.redwoodinspection.com | (925) 935-1499 |
| SAE | SAE International (Society of Automotive Engineers) www.sae.org | (877) 606-7323 (724) 776-4841 |
| SBCCI | Southern Building Code Congress International, Inc. (See ICC) | |
| SCTE | Society of Cable Telecommunications Engineers www.scte.org | (800) 542-5040 (610) 363-6888 |
| SDI | Steel Deck Institute www.sdi.org | (847) 458-4647 |
| SDI | Steel Door Institute www.steeldoor.org | (440) 899-0010 |
| SEFA | Scientific Equipment and Furniture Association www.sefalabs.com | (877) 294-5424 (516) 294-5424 |
| SEI/ASCE | Structural Engineering Institute/American Society of Civil Engineers (See ASCE) | |
| SIA | Security Industry Association www.siaonline.org | (866) 817-8888 (703) 683-2075 |

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| SJI | Steel Joist Institute www.steeljoist.org | (843) 293-1995 |
| SMA | Screen Manufacturers Association www.smainfo.org | (773) 636-0672 |
| SMACNA | Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org | (703) 803-2980 |
| SMPTE | Society of Motion Picture and Television Engineers www.smpte.org | (914) 761-1100 |
| SPFA | Spray Polyurethane Foam Alliance www.sprayfoam.org | (800) 523-6154 |
| SPIB | Southern Pine Inspection Bureau www.spib.org | (850) 434-2611 |
| SPRI | Single Ply Roofing Industry www.spri.org | (781) 647-7026 |
| SRCC | Solar Rating and Certification Corporation www.solar-rating.org | (321) 638-1537 |
| SSINA | Specialty Steel Industry of North America www.ssina.com | (800) 982-0355 (202) 342-8630 |
| SSPC | SSPC: The Society for Protective Coatings www.sspc.org | (877) 281-7772 (412) 281-2331 |
| STI | Steel Tank Institute www.steeltank.com | (847) 438-8265 |
| SWI | Steel Window Institute www.steelwindows.com | (216) 241-7333 |
| SWPA | Submersible Wastewater Pump Association www.swpa.org | (847) 681-1868 |
| TCA | Tilt-Up Concrete Association www.tilt-up.org | (319) 895-6911 |
| TCNA | Tile Council of North America, Inc. (Formerly: Tile Council of America) www.tileusa.com | (864) 646-8453 |
| TEMA | Tubular Exchanger Manufacturers Association, Inc. www.tema.org | (914) 332-0040 |
| TIA | Telecommunications Industry Association (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance) www.tiaonline.org | (703) 907-7700 |
| TIA/EIA | Telecommunications Industry Association/Electronic Industries Alliance | |

(See TIA)

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| TJC | The Joint Commission www.jointcommission.org (formerly known as JCAHO “Joint Commission on Accreditation of Healthcare Organizations.) | (630) 792-3007 |
| TMS | The Masonry Society www.masonrysociety.org | (303) 939-9700 |
| TPI | Truss Plate Institute www.tpinst.org | (703) 683-1010 |
| TRI | Tile Roofing Institute www.tilerroofing.org | (312) 670-4177 |
| UL | Underwriters Laboratories Inc. www.ul.com | (877) 854-3577 |
| UNI | Uni-Bell PVC Pipe Association www.uni-bell.org | (972) 243-3902 |
| USGBC | U.S. Green Building Council www.usgbc.org | (800) 795-1747 |
| USITT | United States Institute for Theatre Technology, Inc. www.usitt.org | (800) 938-7488 (315) 463-6463 |
| WASTEC | Waste Equipment Technology Association www.wastec.org | (800) 424-2869 (202) 244-4700 |
| WCLIB | West Coast Lumber Inspection Bureau www.wclib.org | (800) 283-1486 (503) 639-0651 |
| WCMA | Window Covering Manufacturers Association www.wcmanet.org | (212) 297-2122 |
| WDMA | Window & Door Manufacturers Association www.wdma.com | (800) 223-2301 (312) 321-6802 |
| WI | Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org | (916) 372-9943 |
| WMMPA | Wood Moulding & Millwork Producers Association (See MMPA) | |
| WSRCA | Western States Roofing Contractors Association | (800) 725-0333 |

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| | www.wsrca.com | (650) 938-5441 |
| WWPA | Western Wood Products Association www.wwpa.org | (503) 224-3930 |

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

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| IAPMO | International Association of Plumbing and Mechanical Officials www.iapmo.org | (909) 472-4100 |
| ICC | International Code Council www.iccsafe.org | (888) 422-7233 |
| ICC-ES | ICC Evaluation Service, LLC www.icc-es.org | (800) 423-6587 (562) 699-0543 |

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

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| COE | Army Corps of Engineers www.usace.army.mil | (202) 761-0011 |
| CPSC | Consumer Product Safety Commission www.cpsc.gov | (800) 638-2772 (301) 504-7923 |
| DOC | Department of Commerce National Institute of Standards and Technology www.nist.gov | (301) 975-4040 |
| DOD | Department of Defense http://dodssp.daps.dla.mil | (215) 697-2664 |
| DOE | Department of Energy www.energy.gov | (202) 586-9220 |
| EPA | Environmental Protection Agency www.epa.gov | (202) 272-0167 |
| FAA | Federal Aviation Administration www.faa.gov | (866) 835-5322 |
| FG | Federal Government Publications www.gpo.gov | (202) 512-1800 |
| GSA | General Services Administration www.gsa.gov | (800) 488-3111 (202) 619-8925 |
| HUD | Department of Housing and Urban Development | (202) 708-1112 |

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| | www.hud.gov | |
| LBL | Lawrence Berkeley National Laboratory Environmental Energy Technologies Division http://eetd.lbl.gov | (510) 486-4000 |
| OSHA | Occupational Safety & Health Administration www.osha.gov | (800) 321-6742 |
| SD | Department of State www.state.gov | (202) 647-4000 |
| TRB | Transportation Research Board National Cooperative Highway Research Program www.trb.org | (202) 334-2934 |
| USDA | Department of Agriculture Agriculture Research Service U.S. Salinity Laboratory www.ars.usda.gov | (202) 720-3656 |
| USDA | Department of Agriculture Rural Utilities Service www.usda.gov | (202) 720-2791 |
| USDJ | Department of Justice Office of Justice Programs National Institute of Justice www.ojp.usdoj.gov | (202) 307-0703 |
| USP | U.S. Pharmacopeia www.usp.org | (800) 227-8772 (301) 881-0666 |
| USPS | United States Postal Service www.usps.com | (202) 268-2000 |

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

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| CFR | Code of Federal Regulations Available from Government Printing Office www.gpo.gov/fdsys | (866) 512-1800 (202) 512-1800 |
| DOD | Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil | (215) 697-2664 |
| DSCC | Defense Supply Center Columbus (See FS) | |
| FED-STD | Federal Standard (See FS) | |

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014240 – MUHA DOCUMENTATION STANDARDS

PART 1 - GENERAL

1.1 DOCUMENT FORMAT

- A. All project documents shall be submitted electronically in one of the following formats unless otherwise agreed in writing by the MUSC Project Manager:
 - 1. Adobe PDF
 - 2. Microsoft Word 2003
 - 3. Microsoft Excel 2003
 - 4. Microsoft PowerPoint 2003
 - 5. AutoCAD Version 2007 or Version 2010
- B. Each document shall be a separate electronic document file (i.e. multiple documents shall not be combined into one PDF file, etc.).
- C. Each electronic document file shall be named such that the file's contents can be understood by the file name. File Name Format shall be as called out in specification section if applicable.
- D. The number of paper copies of each document type to be submitted should be determined with the MUSC Project Manager on each project.
- E. The MUHA Drafting Standards Manual requirements shall be followed for all drawings submitted to MUSC.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 014240

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Section 015120 "Environment of Care (EOC) and Safety Compliance."

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

- C. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
1. Locations of dust-control barriers at each phase of work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air-filtration system discharge.
 4. Waste handling procedures.
 5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70 and OSHA requirements.
- B. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Staging Areas: No designated lay down or material storage area outside the defined construction area is available for contractors due to lack of space in the hospital. Contractors must provide for their own storage of materials.

2.3 EQUIPMENT

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

- B. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas. Refer to Section 015120 for infection control measures.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Connect to Owner's existing electric power service as approved and directed by Owner. All connections to Owner's power sources must be through ground fault interrupter (GFI) devices. Maintain equipment in a condition acceptable to Owner in accordance with code and safety requirements.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Install lighting for Project identification sign.
- I. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Provide superintendent with computer or device capable of email communication.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Parking: Parking cost is responsibility of Contractor. No designated contractor parking areas are provided due to lack of space.
- C. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Temporary Signs: Provide signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 2. Maintain and touchup signs so they are legible at all times.
 3. Signs must be professional (not hand-written).
 4. Safety Signs: Provide as indicated in other specification sections such as Section 015120.

- D. Waste Removal and Disposal: Provide clean, enclosed waste-collection containers with tight fitting dust covers on site in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
 - 1. Waste dumpsters are to be provided by as stated in 011000 "Summary".
- E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- F. Existing Elevator Use: Use of Owner's existing elevators will not be permitted.
- G. Existing Stair Usage: Use of Owner's existing stairs will not be permitted.

3.4 PROTECTION OF FACILITIES INSTALLATIONS

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- E. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- G. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, or continuous plastic between gypsum board and stud in lieu of tape.

2. Construct dustproof barrier of one layer of polyethylene sheet. Tape all around barrier tight to existing surfaces with no gaps or wrinkles. Periodically inspect and retape as necessary to maintain integrity of installation. Overlap and tape joints full length.
 3. Construct vestibule and airlock at each entrance through temporary partition or barrier with not less than 48 inches between doors. Maintain water-dampened foot mats or tacky walkoff mats in vestibule.
 - a. Access through partition to be by way of temporary door and hollow metal frame.
 - b. Access through barrier to be by way of zippered plastic set in barrier. Periodically inspect and replace broken zipper as necessary to maintain integrity of barrier.
 4. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies and paragraph 1 above.
 5. Insulate partitions to control noise transmission to occupied areas.
 6. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 7. Protect air-handling equipment.
 8. Provide walk-off mats at each entrance through temporary partition.
- H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage the posted ILSM program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with MUHA Safety Coordinator and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.

6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

DOCUMENT 015120 - ENVIRONMENT OF CARE (EOC) AND SAFETY COMPLIANCE

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 requirements to ensure a safe Environment of Care (EOC) to protect patients, visitors, and staff during construction.
- B. The EOC process manages the following environmental risks:
 - 1. Infection Control
 - 2. Interim Life Safety
 - 3. Occupational Safety & Health
 - 4. Hazardous Materials
 - 5. Security
 - 6. Noise and Vibration
 - 7. Utility System Integrity

1.3 DEFINITIONS

- A. Environment of Care (EOC) Permit: The work practice measures required by MUHA to comply with regulatory agencies.
- B. Interim Infection Control Measures (IICM): Work practices required in the EOC permit to prevent dust migration.
- C. Infection Control Risk Assessment (ICRA): An assessment of health risks related to construction, renovation and repair activities to determine which Interim Infection Control Measures need to be implemented.
- D. Containment Areas: Includes areas of renovation or construction within or additions to occupied facilities; adjacent staging and storage areas; passage areas for contractors; supplies and waste; and ceiling spaces above and adjacent to construction.
- E. Protection Areas: Interior occupied areas within facilities which are adjacent to Containment Areas, either occupied or used for passage, as well as areas connected to construction areas by mechanical distribution systems.
- F. Interim Life Safety Measures (ILSM): Work practices required in the EOC permit to prevent fires.
- G. Hospital Acquired Infections (HAI): Patient infection obtained while in the hospital.
- H. Barrier: Physical separation between Containment Areas and Protection Areas. Barriers can be either hard partitions or soft polyethylene barriers.

1.4 QUALITY ASSURANCE

- A. Interim Infection Control Measures (IICM) provide additional safety for patients, visitors, and staff when there are conditions outside of normal hospital operation that increase the risk of Hospital Acquired Infections (HAI). The most notable risk of HAI associated with construction activities is inhalation of airborne contaminants. Prior to the start of construction, MUHA performs an Infection Control Risk Assessment (ICRA) to determine the IICM required in the Environment of Care (EOC) permit. Contractor shall adhere to these measures.
1. Construction, renovation and repair activities may generate dust and debris that contain suspended fungal spores. Fungal spores can be carried by air currents to remote locations within a facility. Control of these airborne contaminants is imperative to prevent possible HAI. Airborne contaminant producing activities include, but are not limited to:
 - a. Demolition and removal of walls, floors, ceilings and other finish materials.
 - b. Demolition of plumbing, mechanical and electrical systems and equipment.
 - c. Finish operations such as sanding, painting, and application of special surface coatings.
 - d. Lifting of ceiling tiles and any work above the ceiling
 - e. Other construction activity that may generate dust, smoke or fumes.
 - f. Site operations adjacent to occupied facilities.
 2. Owner may provide baseline particle counts and conduct periodic air sampling of areas outside of Containment Areas during construction to monitor effectiveness of the IICM measures.
 3. Protect indoor air, absorbent materials, and mechanical systems from contamination in accordance with ASHRAE-62, Chapter 7.
 4. Contractor shall verify the maintenance of negative air pressure in Containment Area relative to Protection Areas on a continuous basis by use of differential pressure monitors.
- B. Interim Life Safety Measures (ILSM) provide additional safety for patients, visitors, and staff when conditions outside normal hospital operations compromise standard life safety controls. Prior to the start of construction, MUHA performs an Interim Life Safety Risk Assessment to determine the ILSM required in the Environment of Care (EOC) permit. Contractor shall adhere to these measures.
1. Manage risks associated with compromises to fire detection, alarm and suppression systems in affected areas. Ensure appropriate ILSM measures are assessed, implemented and maintained throughout the project duration
- C. Occupational Safety & Health
1. Contractor shall comply with applicable OSHA 29 CFR 1910 and 29 CFR 1926 requirements.
 2. Contractor shall have in place and maintain a company Safety Program that includes at a minimum:
 - a. company safety policies and procedures
 - b. documented training for all employees on company safety policies and procedures
 - c. documented training for all employees on required OSHA topics (awareness and detailed level training)
- D. Hazardous Materials
1. Contractor shall not bring or store hazardous materials on-site without written permission from Owner
 2. Hazardous Materials on-site must be limited to only the daily quantity required to perform that day's scheduled work.
 3. Hazardous Materials must be properly stored in accordance with regulatory and manufacturer's requirements.

E. Security

1. Contractor shall ensure that all employees have current MUSC Contractor Identification Badges per Section 013100 requirements and wear badges in a visible location at all times they are working on MUSC/MUHA property.
2. Contractor shall ensure the integrity of existing security measures and devices in place at the time the contractor occupies the site and throughout the entire project timeline. No modifications, relocation or removal of security devices (including but not limited to cameras, lock hardware, electronic door security, and abduction alarms) is permitted without coordination and written approval from Owner.
3. MUHA and MUSC assume no liability for contractor-owned property.
4. Private locks are authorized only for use with contractor-owned or personal property. Contractor shall not use private locks to secure MUHA or MUSC property.

F. Noise & Vibration can cause major impact to patient care.

1. Contractor shall coordinate and schedule work such that patient care is not compromised by Noise and Vibration.

G. Utility System Integrity

1. Contractor shall ensure the integrity of Utility Systems throughout all phases of construction such that patient care is not compromised.

H. MUHA Contractor Safety Training Requirements

1. The MUHA Contractor Safety Training Program is administered on behalf of MUHA by the non-profit firm "Mid Atlantic Safety Council" (MASC). The contact information for MASC is as follows:
 - a. Website: www.ma-sc.org
 - b. Phone: 910-762-9557
2. The MUHA Contractor Safety Training Program consists of the following two training sessions provided through MASC:
 - a. Basic Orientation Plus™ (OSHA Awareness Level Training)
 - b. MUHA Site Specific Safety Training
 - c. Annual refresher training is required to maintain current training status. Upon successful completion of the training program, employees will be issued a MASC Training ID Card. MASC also maintains a Training Records database.

I. If Contractor fails to maintain the Environment of Care or Safety measures described in permits or specifications:

1. Owner may issue notice of non-conformance.
2. Contractor shall correct non-conformances immediately.
3. If issues are not corrected immediately upon receipt of notice of non-conformance, Owner will have cause to stop Work at Contractor's expense until issues are corrected.
4. Failure of Contractor to correct non-conformances may result in Owner taking required corrective action and deducting all associated costs from Contract Amount.
5. Failure of Contractor to correct non-conformances or if Contractor shows trends of repeated noncompliance, the Contractor may be removed from the project for Cause as provided in Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIAL DESCRIPTIONS

- A. Air Purifiers (Scrubbers):
 - 1. Units shall include Pre-filters, Final Filters, HEPA filters, Filter static pressure gauges, and Filter Differential Pressure Gauges.
 - 2. HEPA filters shall be 99.997% efficient at 0.3 micron particle size.
- B. Portable Prefabricated Enclosure Units: Must be approved by Owner prior to use.
- C. Polyethylene:
 - 1. Reinforced fire resistant sheet, 10 mil thickness (minimum), with flame spread rating of 15 or less per ASTM E84 and passing NFPA 701 test methods.
 - 2. Fire retardant type listed by UL.
- D. Air Pressure Monitor (switch/gauge):
 - 1. Shall continuously indicate differential pressure between two areas, be easily accessible, and be visible.
 - 2. Must be approved by Owner prior to use.
- E. Insulation:
 - 1. Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool, with maximum flame spread rating of 25 and maximum smoke development index of 50.
- F. Adhesive-Faced Contamination Control Mats (Tacky Mats): Must be approved by Owner prior to use.
- G. Fan for Creation of Negative Pressure: Must be approved by Owner prior to use.
- H. Sweeping Compound: Must be approved by Owner prior to use.
- I. Walk-Off Mats: Must be approved by Owner prior to use.

PART 3 - EXECUTION

3.1 ENVIRONMENT OF CARE BARRIERS

- A. Contractor shall provide dustproof and/or fire rated barriers separating the Work in a Containment Area from Protection Areas as required on drawings and/or required by Interim Infection Control Measures (IICM) or Interim Life Safety Measures (ILSM) to protect these areas from dust, fumes, other airborne contaminants, or noise/vibration.
 - 1. Contractor shall provide dustproof and/or fire rated barriers and have Owner inspect barriers prior to starting construction activities in the Containment Area.
 - 2. Barriers shall be constructed per requirements of the Temporary Partitions paragraphs in Section 015000 "Temporary Facilities and Controls".
 - 3. Barriers shall include an air lock isolation vestibule if required on drawings and/or required by Interim Infection Control Measures (IICM) or Interim Life Safety Measures (ILSM).
 - 4. Contractor shall post required regulatory signage (such as PPE requirements, construction area warnings, etc.) at barrier entrance locations.

B. Barriers Within a Protection Area

1. Whenever Work is necessary outside of an established Containment Area:
 - a. Work shall be coordinated and scheduled in advance with Owner.
 - b. Provide a polyethylene dustproof barrier (unless otherwise indicated by IICM or ILSM) to contain work. Contractor may use portable prefabricated enclosure unit.
 - c. At no time shall any construction equipment or material be stored outside construction barriers.
 - d. Dust tracked outside of construction area shall be cleaned up immediately.
 - e. Provide dedicated manpower and equipment (HEPA filtered vacuums, walk-off mats, dust and wet mops, buckets and clean wiping rags) to keep adjacent areas clean at all times.

C. Work Confined to Individual Rooms in a Protection Area

1. Miscellaneous Work activities required within a Protection Area which can be confined to unoccupied, individual rooms shall be performed as follows:
 - a. Notify Owner at least 7 days prior to commencing Work in room.
 - b. Treat room as a Containment Area and provide dustproof barrier:
 - 1) If work is of short duration, dustproof barrier can be established by closing door and taping with painters tape from the inside while Work is being performed.
 - 2) If work is of longer duration and/or there will be traffic through door, provide a polyethylene dustproof barrier outside of door with a zippered opening for access.
 - c. Provide tacky mats inside and outside of room and change them frequently.
 - d. Cap HVAC ductwork or seal air diffusers and grills.
 - e. Provide Negative Pressure System or Air Purifier in room as required by Owner.
 - f. At no time shall any construction equipment or material be stored outside room.
 - g. Provide dedicated manpower and equipment (HEPA filtered vacuums, walk-off mats, dust and wet mops, buckets and clean wiping rags) to keep adjacent areas clean at all times.
 - h. Clean up any dust/dirt tracked outside of room immediately.
 - i. Vacuum and clean all surfaces free of dust after completion of Work and prior to turnover to Owner.

D. Access and Work in Existing Ceiling Spaces

1. Removal of one (1) acoustic ceiling tile or opening of one (1) access hatch per 50 square feet without an enclosure is allowed in Protection Areas. Tile or hatch must be put back in place immediately after work is complete.
2. Miscellaneous Work activities required within existing ceiling spaces in a Protection Area or occupied space shall be performed as follows:
 - a. Schedule in advance and notify Owner at least 7 days prior to commencing Work.
 - b. Whenever acoustical ceiling tiles are moved or access panels are opened in Protection Area or occupied areas, perform tasks as specified in 3.1.B above if in an open Protection Area or as specified in 3.1.C if work is confined to an individual room that can be vacated.
 - c. When Work is being performed above a ceiling and Work must be performed while area is occupied, provide temporary work surfaces to provide a safe working platform and protect ceiling and the spaces below from falling objects and materials. Take all necessary precautions to protect people and spaces below temporary work surfaces from injury due to Contractor's operations.
 - d. Spray top of ceiling system to be removed, as well as surrounding affected ceiling area, with fine water mist to settle dust prior to removal. Take care not to saturate material or create puddles of water.

- e. Any acoustical ceiling tiles moved or access panels opened for investigation outside of Containment Areas shall be replaced or closed immediately when unattended.
- f. When performing wet work such as plumbing, pipe removal, etc., provide a watertight barrier beneath the work area to catch and retain all spillage before it would reach the ceiling below.
- g. Removal of all above ceiling protection shall be done carefully.
- h. Vacuum and clean all surfaces, including top of ceiling system in above ceiling work area to ensure that they are free of dust and debris. Accomplish thorough cleaning of surfaces that become exposed to dust by use of either a HEPA-filtered vacuum cleaner or wet mop.

E. General Requirements for Barriers:

- 1. Openings must be kept tightly closed and sealed immediately after entering or leaving.
- 2. Sealing of Openings:
 - a. Use tape or impenetrable sealant to seal barrier wall seams, cracks around window and door frames, ductwork, pipes and conduits.
 - b. Penetration of dust-proof barriers shall be sealed on both sides and 360 degrees around penetrating objects.
 - c. Fasten windows shut
- 3. At a minimum, Contractor shall inspect integrity of all barriers before starting work each day and at two hour intervals during work hours. Repairs should be made immediately upon being aware of deficiencies. Contractor shall maintain an adequate inventory of barrier repair materials (polyethylene, tape, zippers, etc.) on site to comply.
- 4. Traffic between Containment Areas and Protection Areas shall be kept to a minimum.
- 5. Provide adequate manpower and equipment (HEPA filtered vacuums, walk-off mats, dust and wet mops, buckets and clean wiping rags) to keep Protection Areas clean at all times.
- 6. Barriers shall not be removed prior to adequate cleaning inside Containment Area and approval from Owner.

3.2 AIR PURIFICATION AND NEGATIVE AIR SYSTEM REQUIREMENTS

- A. Provide Negative Pressure System or Air Purifier (as stipulated by Owner) in enclosed Containment Areas.
- B. Airborne Contaminant Control within an Containment Area shall be provided by one or more of the following:
 - 1. Air Purification (Scrubbing) is recirculating air within a Containment Area using filtration to remove contaminants. Air Scrubbing does not create a negative pressure inside the Containment Area relative to adjacent areas.
 - 2. Negative Air Systems use an Air Purifier or Fan to pull air from within a Containment Area and exhaust it outside the Containment Area. Negative Air Systems create a negative pressure inside the Containment Area relative to adjacent areas. Negative Air Systems can exhaust outside of a building's exterior wall or inside the building into areas adjacent to the Containment Area. Refer to Interim Infection Control Measures (IICM) for specific Negative Air System requirements:
 - a. Outside Exhaust of Negative Air Systems
 - 1) Direct exhaust of Air Purifier or Exhaust Fan to outside of building away from building intake louvers, operable windows, and doors.
 - 2) Vent Air Purifiers or Exhaust Fans to outside by removing existing windows and replacing them with vented panels having fittings for exhaust holes. Panels shall maintain weather resistance.

- b. Inside Exhaust of Negative Air Systems
 - 1) Air Purifier must be used when exhausting into inside areas adjacent to Containment Area.
 - 2) Location and direction of an inside exhaust must be approved by Owner.
 - 3) A diffuser device must be installed in the exhaust on the exterior side of the containment area.
 - c. Provide differential pressure monitor at locations approved by owner.
 - d. Negative Air System used shall be capable of maintaining negative pressure in Containment Area with all doors fully open.
- 3. Air Purifier or Negative Air System equipment shall be connected to emergency power when possible and shall run continuously.
 - 4. Differential Pressure (DP) across filters on Air Purifiers shall be checked daily (at a minimum) to ensure proper filter operation. Contractor shall log checks of filter DP. Contractor shall replace filters as necessary to maintain proper DP across filters.
- C. Provide adequate ventilation of interior enclosed areas to cure installed materials, to prevent excessive humidity, and to prevent hazardous accumulations of dust, fumes vapors or gases.
 - D. Contractor shall provide additional localized exhaust and/or air purification during welding, vapor producing Work, or when installing wet products (fluid applied coatings, adhesives, etc.) to remove hazards and odors.
 - E. When feasible, Owner shall turn off mechanical air supply and return systems. When not feasible, Contractor shall cap all existing ventilation supply ducts within Containment Areas to withstand airflow and cap all existing return ducts within Containment Areas so they are dust tight.

3.3 INFECTION CONTROL

- A. Contractor shall ensure that all workers on site know where the Environment of Care (EOC) permit for the project is posted
- B. Contractor shall ensure that all workers on site are trained on the requirements of the EOC permit, specifically the Interim Infection Control Measures (IICM).
- C. Contractor shall take appropriate steps throughout duration of Project to prevent dirt, dust, and other airborne contaminants due to Work from spreading outside of Containment Areas. These tasks include, but are not limited to the following:
 - 1. Spray surfaces with water mist during dust-producing demolition activities. Take care to avoid accumulation of standing water or saturation of any materials.
 - 2. For hard surface floors in work area, adjacent hallways and passage areas, use HEPA filtered vacuum cleaners and frequent wet mopping during demolition and construction.
 - 3. Protect adjacent carpeted areas with plastic and heavy Kraft paper, and vacuum with HEPA-filtered vacuum cleaners.
 - 4. Vacuum walk-off mats daily and as needed to eliminate tracking of dust into other areas.
 - 5. Execute work by methods to minimize raising dust from construction operations.
 - 6. Use HEPA-filtered vacuum cleaner and/or wet cloth to thoroughly clean surfaces that become exposed to dust.
 - 7. Provide tacky mats on inside and outside of Containment Area entrances to reduce tracking of dust into Protection Areas. Change tacky mats at least twice per day, but as often as needed to ensure they work effectively.
 - 8. Instruct personnel to refrain from tracking dust into adjacent areas or opening windows or doors that would allow airborne contaminants into adjacent hospital areas.

9. Use tightly covered and sealed containers for removal of trash or debris through Protection Areas or occupied spaces. All containers and container wheels must be wiped down before being removed from a Containment Area
10. Use only specified contractor entrance routes, material delivery routes, and debris removal routes approved by Owner.

D. Broom Sweeping:

1. Broom sweeping is not allowed in Protection Areas.
2. Broom sweeping is allowed in Containment Areas under negative pressure and with use of sweeping compound, unless otherwise directed by Owner.

E. Exterior Work: Direct exhaust generated by equipment away from building air intakes, windows or doors. Coordinate with Owner to ensure that filters on building air intakes are operational and protected from excessive amounts of airborne contaminants. Contractor shall supply additional filtration methods required.

F. Provide thorough cleaning of all surfaces that become exposed to dust prior to turnover to Owner for occupancy.

G. Prior to exiting a Containment Area, contractors must ensure all dust is removed from clothing.

H. All vacuuming outside of Containment Areas shall be with a HEPA-filtered vacuum.

I. Remove enclosures and barriers carefully to minimize spreading dust and debris. Transport waste and materials in tightly covered and sealed containers or carts.

J. Vacuum and/or wet mop and clean all surfaces free of dust after removal of enclosures and barriers.

3.4 INTERIM LIFE SAFETY

A. Contractor shall ensure that all workers on site know where the Environment of Care (EOC) permit for the project is posted

B. Contractor shall ensure that all workers on site are trained on the requirements of the EOC permit, including the Interim Life Safety Measures (ILSM), the Emergency Contact Information, and the Emergency Response Information.

C. Provide Fire Watch in accordance with NFPA 241 with documentation on Owner provided forms.

D. Provide directional signage for alternate exits as required.

E. Ensure proper, unobstructed egress is maintained to all exits.

F. Provide adequate numbers of fire fighting equipment (fire extinguishers) of proper size and type, ensure it is located in accessible locations, and ensure all Contractor employees are trained on its use.

G. Contractor performs and documents daily safety inspections of area.

H. Limit storage and ensure effective housekeeping to reduce flammable and combustible fire load to the lowest feasible level.

I. Contractor shall notify owner 72 hours in advance to obtain a posted Fire System Impairment Permit prior to:

1. impairment of fire alarm systems (including testing)
2. impairment of fire suppression systems (including testing)
3. hot work, including but not limited to, welding, soldering, burning, and grinding.

J. Smoking / Tobacco use is not permitted anywhere on the entire MUHA / MUSC Campus. Smoking or using Tobacco of any kind on campus is grounds for dismissal from the site. By accepting to undertake this project the Contractor agrees for all employees and sub-contractors to not only not smoke anywhere on campus but to not allow anyone to smoke anywhere anytime during their work period on site.

3.5 OCCUPATIONAL SAFETY AND HEALTH

- A. While working on the MUSC campus, Contractor shall conduct a documented Employee Safety Meeting at least once per week to discuss safety topics relevant to the specific project on which the Contractor is working.
- B. Contractor shall maintain a complete Material Safety Data Sheets (MSDS) Book (hardcopy) with all other documentation within the construction site and shall follow MSDS instructions for personal protective equipment, spill cleanup, etc.
- C. Contractor shall maintain evidence of their Company Safety Program required in Paragraph 1.4.C. Contractor shall coordinate their Safety Program with MUHA specific policies on elements such as Confined Space, Lockout-Tagout, Hot Work, etc.
- D. Confined Space Work: Contractor shall use own confined space procedures coordinated with owner and ensure proper training of personnel working in designated confined spaces. Contractor shall provide all necessary equipment and supplies required for work in a confined space.

3.6 HAZARDOUS MATERIALS

- A. Flammable liquids and gas must be stored in authorized flammable storage cabinets. Eliminate ignition sources and provide appropriate signage. Proper grounding and bonding of containers is required. An additional fire extinguisher rated for the hazard must be provided in the area.
- B. Compressed gas cylinders must be secured to an appropriate structure to prevent accidental tipping or upset. Unused cylinders must be capped. Have only the cylinders needed for immediate use at the job site; remove empty or unneeded cylinders daily.
- C. Asbestos containing materials will be identified and removed by Owner before demolition or renovation activities begin. Owner will provide Asbestos Survey Reports as required per Section 003126. If Contractor suspects Asbestos Containing Building Materials (ACBM) are present, immediately stop work, remove personnel from area, and notify Owner.
- D. If Contractor suspects any other hazardous materials (i.e. Lead, PCBs, or other Chemicals) are present, immediately stop work, remove personnel from area, and notify Owner

3.7 SECURITY

- A. Contractors must give the MUHA Project Manager 48 hours notice of proposed after hours work including information on project location, nature of the work, and what companies will be involved in the work. The MUHA Project Manager will notify Security of proposed work in advance. Contractor must notify Security when they arrive for after hours work. Phone numbers for Security will be provided by the MUHA Project Manager

- B. Contractors are responsible for securing their materials. Minimize the storage of valuable materials and equipment. Secure items when not in use.

3.8 NOISE AND VIBRATION

- A. Contractor shall coordinate any construction work that causes excessive noise or vibration (e.g. jack hammering, hammer drilling, shooting anchors, etc.) in adjacent areas with the Owner.
- B. Contractor shall immediately stop work creating noise and/or vibration if requested by any Owner representative. If this occurs, Contractor shall immediately notify Project Manager to coordinate the restart of work.

3.9 UTILITY SYSTEM INTEGRITY

- A. Prior to any work on utility systems, Contractor shall perform due diligence to identify whether utility system affects areas occupied by Owner.
- B. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary utility services according to the requirements indicated:
 - 1. Notify Owner not less than ten (10) calendar days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written approval.
- C. Contractor shall coordinate with Project Manager prior to tracing any utility system outside the Containment Area.

3.10 MUHA CONTRACTOR SAFETY TRAINING PROGRAM

- A. Contractor shall ensure all permanent contractor employees have successfully completed the MUHA Contractor Safety Training prior to starting any work on MUSC / MUHA property. Day Labors and Temporary Employees working for the Contractor are not required to take this training.
 - 1. Contact Mid-Atlantic Safety Council (MASC) to schedule training. MASC will provide information on scheduling options, class availability, costs, etc.
- B. To successfully complete the MUHA Contractor Safety Training Program requirements, Contractor employees shall:
 - 1. Attend and actively participate in the Mid Atlantic Safety Council's Basic Orientation Plus™ (BOP) training (approximately 5.5 hours long)
 - a. English language instructor (preferred)
 - b. Spanish language instructor (acceptable)
 - 2. Pass the BOP training test with a score of 80% or better
 - a. written testing in English (preferred)
 - b. written testing in Spanish (acceptable)
 - 3. Complete the self paced, computer based MUHA Site Specific Safety Training (approximately 1 hour long)

- a. only English language program acceptable
4. Pass the MUHA Site Specific Training test with a score of 80% or better
 - a. only written, English language testing acceptable
5. Attend annual refresher training and successfully pass refresher tests for both the BOP and MUHA Site Specific Training sessions.
- C. Upon successful completion, a MASC Training Identification badge will be issued. Contractors must wear the badge in an easily visible location in addition to their MUSC issued Contractor Identification Badge at all times on MUSC / MUHA property. Contractors not displaying this badge may be asked to leave the MUSC campus.
- D. A supervisory level, permanent Contractor employee, who has successfully completed the required contractor safety training shall be onsite at all times to directly supervise and be responsible for Day Laborers and Temporary Employees working for the contractor.

END OF SECTION 015120

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. 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; material safety information; and comparable products.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 013300 "Submittal Procedures" for requirement for submittals.
 - 4. Section 014200 "References" for applicable industry standards for products specified.
 - 5. Section 017700 "Closeout Procedures" for warranty submittals.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process 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. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," 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 additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 14 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Material Safety Data Sheets: Contractor is responsible for maintaining a Material Safety Data Sheet (MSDS) Book at the construction site that is easily accessible and available upon request at any time. The MSDS Book must contain the most current MSDS for all chemicals or substances used by the General Contractor or sub-contractors during work performed.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine 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. Protect 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.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Installation of the Work.
2. Cutting and patching.
3. Coordination of Owner-installed products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

- B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 017701 "DHEC Construction Inspections" for procedural requirements for South Carolina Department of Health and Environmental Control (DHEC) Inspections.
5. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
6. See MEP drawings for information regarding "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection. When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching.
 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include, but are not limited to, the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Fire-Resistive Construction:
 1. Protect fire-resistive materials according to manufacturer's instructions to prevent damage resulting from cutting and patching or other causes. Ensure that fire protection is without damage or deterioration at time of Substantial Completion.
 2. Patch fire-resistive construction in such a manner to maintain established fire ratings. Refer to Section 078413 "Penetration Firestopping" and Section 078446 "Fire Resistive Joint Systems".
 3. Provide temporary fire resistive materials during cutting, patching and penetration of fire or smoke rated construction. Contractor may not leave site without installing temporary protection.
- F. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- G. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- H. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- J. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.7 STARTING AND ADJUSTING
- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
 - B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
 - C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Warranties.
2. Substantial Completion procedures.
3. Final completion procedures.
4. Final cleaning.
5. Repair of the Work.

- B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017701 "DHEC Construction Inspections" for procedural requirements for South Carolina Department of Health and Environmental Control (DHEC) Inspections.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals in a format compatible with the O&M Manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Submittals Prior to Architect's Preliminary Inspection: Complete the following a minimum of 10 days prior to Architect's Preliminary Inspection for determining Substantial Completion.

1. Submit written request for preliminary inspection.
2. Submit closeout submittals specified in other Division 01 Sections, including operation and maintenance manuals, damage or settlement surveys, and similar final record information.
3. Submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
4. Submit closeout submittals specified in Technical Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
5. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Remove tools, construction equipment, machinery, and surplus material from Project site.
6. Submit closeout documentation per Section 017702 MUHA Compliance Closeout Documentation.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- B. Procedures Prior to Architect's Preliminary Inspection: Complete the following a minimum of 10 days prior to Architect's Preliminary Inspection for determining Substantial Completion.

1. Advise Owner of pending insurance changeover requirements.
2. Contractor and Architect set date and time for Substantial Completion Inspection.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
6. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- C. Architect's Preliminary Inspection: Architect will proceed with a preliminary inspection approximately two (2) weeks prior to the milestone Substantial Completion date on the schedule. The Architect will prepare a punch list that must be completed by the Substantial Completion date. At the preliminary inspection the Architect will also:

1. Validate the Contractor record document redlines noting the errors and omissions on the punch list.
2. Contact DHEC Construction to schedule the DHEC Final inspection.
3. Communicate with the Owner's maintenance group on any deficiencies they are aware of and incorporate those items on the punch list.
4. Validate the Contractor Closeout Submittals noting the errors and omissions on the punch list.

- D. Substantial Completion: On the date established for Substantial Completion:

1. Contractor submits Document 017700A "Contractor Request for Certificate of Substantial Completion" to request Substantial Completion.

2. Architect will perform a Substantial Completion Inspection and verify Contractor completion of the punch list items related to Substantial Completion.
3. Architect will prepare an SE-550 "Certificate of Substantial Completion" after inspection or will notify Contractor of items, either on the list or additional items identified by the Architect, that must be completed or corrected before the certificate will be issued.
 - a. If Contractor cannot achieve Substantial Completion prior to the day of the DHEC Final Construction Inspection, the DHEC inspection will be cancelled and rescheduled at the expense of the Contractor.
4. Contractor submits remaining compliance documentation including testing and balancing reports, and project record documents.

1.6 FINAL COMPLETION PROCEDURES

- A. Procedures prior to DHEC Final Construction Inspection: After Substantial Completion and prior to the DHEC Final Inspection, complete the following:
 1. Take final record photographs of completed projects.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. All remaining Architect's final punch list items shall be completed, signed by Contractor and counter-signed by Architect.
 4. Contractor's final cleaning.
 5. Remove all temporary barriers and partitions after final cleaning. Must obtain Owners approval prior to removal.
- B. Submittals prior to DHEC Final Construction Inspection: After Substantial Completion but prior to the DHEC Final Inspection provide the following:
 1. Final photographs of completed construction.
 2. Completed Architect's punch list signed and counter-signed.
- C. DHEC Final Construction Inspection: A final construction inspection will be undertaken by the Authority having Jurisdiction.
 1. Contractor shall record work noted during the inspection that is incorrect or otherwise unacceptable on the 017701A - DHEC Construction Punch List Sign-Countersign form.
 2. DHEC will not approve the project until all the items have been corrected. The Contractor completes remaining DHEC punch list items and submits the completed punch list to Architect.
 3. Architect shall submit the punchlist to DHEC along with any other remaining documentation.
 4. Upon satisfactory completion of the DHEC Final Inspection, DHEC Construction will notify DHEC Licensing indicating that the project construction is accepted as ready for occupancy.
 5. Contractor may request release of retainage and may submit final invoice for payment.
- D. Final Completion: Complete tasks in preparation to close out the project and occupy the site.
 1. Architect issues Final Completion documents including an SE-560 "Certificate of Final Completion", and prepares a final Certificate of Payment.
 2. Architect delivers to the Owner the As-Built Record documents.
 3. Owner does a terminal cleaning, and installs movable furniture and equipment.
 4. DHEC Licensure conducts an inspection and grants permission to occupy.

- E. Closure of the construction contract, including final payment to the Contractor, also requires the following:
1. An affidavit, in the form of the AIA G706, that wages, bills for materials and equipment, and other indebtedness connected with the work have been paid.
 2. A certificate in the form of AIA G715 issued by an authorized representative of the contractor's insurance company certifying completed project insurance coverage as required by the contract documents;
 3. A statement that the Contractor knows of no reason that the completed project insurance will not be renewable to cover the period required by the Contract Documents;
 4. Consent of surety, if any, to final payment, in the form of AIA G707;
 5. Other information required by the Agency establishing the Contractor's payment or satisfaction of obligations, such as receipts, release and waivers of liens, claims and security interests arising out of the contract, all in the forms as designated by the Agency;
 6. Inspection reports that may not be a part of the record documents;
 7. Reline drawings showing the as-built conditions;
 8. Warranties;
 9. Operation and maintenance manuals; and
 10. A final payment application.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in a Healthcare Facility. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before DHEC Final Inspection for entire Project or for a designated portion of Project:
 - a. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - b. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - c. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - d. Sweep concrete floors broom clean in unoccupied spaces.
 - e. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

- f. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - g. Remove labels that are not permanent.
 - h. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - i. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - j. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - k. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - l. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - m. Leave Project clean and ready for Inspection.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy ballasts in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

PROJECT NUMBER: _____

PROJECT NAME: _____

PROJECT LOCATION: _____

CERTIFICATION

I hereby certify that FULL or PARTIAL Substantial Completion has been accomplished as defined in the Project Manual and in conformance with the requirements of the Contract Documents. This certification declares that:

- A. The Work that remains to be completed after Full or Partial Substantial Completion is minor in scope and nature.
- B. The remaining Work is not disruptive to the function of the facility occupants and is limited to minor items required to finalize the project. Examples are minor touch-up paint, electrical device cover plates, hardware and window adjustments, and minor repairs to finishes.
- C. The required Contractor's Punchlist is attached. *(Failure to include incomplete work does not relieve the Contractor of the responsibility to complete or correct the work.)*
- D. The other requirements of the Contract have been accomplished, to include delivery of all Compliance Documentation, Operations and Maintenance Data, Record Drawings, Record Specifications, Maintenance Training and Demonstrations, Warranty Certifications, and Startup Activities.

DATES

DATE OF CONTRACTOR'S COMPLETION OF ALL FULL OR PARTIAL SUBSTANTIAL COMPLETION WORK: _____

DATE OF EXPECTED PUNCHLIST COMPLETION: _____
(should not be more than 30 days after Substantial Completion)

SPECIAL CONDITIONS OR STIPULATIONS CONCERNING THE COMPLETION OF PUNCHLIST ITEMS OR EXPLANATIONS OF PARTIAL SUBSTANTIAL COMPLETION:

CONTRACTOR: _____

SIGNATURE: _____

CONTRACTOR REPRESENTATIVE NAME (print):

CONTRACTOR REPRESENTATIVE TITLE (print):

SECTION 017701 – DHEC CONSTRUCTION INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for South Carolina Department of Health and Environmental Control (DHEC) Construction Inspections.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for inspections and closeout procedures.
 - 2. Section 017702 "MUHA Compliance Closeout Documents"

1.3 SUBMITTALS

- A. DHEC Documentation Required for Construction Projects.

1.4 GENERAL

- A. Typically, at least two site construction inspection visits (above-ceiling inspection, and final inspection) must be arranged with Division of Health Facilities Construction staff for each phase of work on a project. These inspection dates are requested through the Architect by the Contractor.

1.5 DHEC ABOVE-CEILING CONSTRUCTION INSPECTION

- A. At the DHEC Above-Ceiling Inspection, DHEC will inspect the Work being undertaken to ensure it is complete. All above ceiling work, including Architect's Above Ceiling Punchlist items, shall be complete so that upon inspection approval, the ceiling can be immediately closed up. If it is obvious that the work above the ceiling is not finished the inspection will be terminated and rescheduled at the Contractor's expense.
- B. Contractor shall request the Architect or Owner to schedule the inspection. When requesting this inspection, Contractor should take into account that the inspection date is contingent on the DHEC Inspector's availability and may be up to 4 weeks from date of request.. DHEC comes for the Above-Ceiling Inspection when the Architect or Owner schedules it on behalf of the Contractor.
- C. The DHEC Inspector requires access to all above ceiling locations during the inspection. All acoustic ceiling tiles must remain uninstalled for the inspection except those around perimeter of space and those required for ceiling mounted devices such as grilles, lights, fire alarm horns/lights, etc. Spaces above hard ceilings must have adequate access for inspection unless previous arrangements have been made with the DHEC Inspector.

1.6 DHEC FINAL CONSTRUCTION INSPECTION

- A. At the Final inspection, DHEC will inspect the work and test all the systems in order to ensure the space is complete and ready to operate as intended. All Work, including Architect's Final Punchlist items, Owner Installed items, and Contractor's Final Cleaning, shall be complete prior to inspection so that upon inspection approval, DHEC Licensing can be contacted for occupancy approval. If at the final inspection it is obvious that the Work is not complete, the final inspection will be terminated and rescheduled at the Contractor's expense.
- B. DHEC comes for the Final Inspection when the Architect or Owner schedules it on behalf of the Contractor. Contractor shall request the Architect or Owner to schedule the inspection.
- C. Upon satisfactory completion of the Final inspection, DHEC Construction will notify DHEC Licensing indicating that the project construction is accepted as ready for occupancy. The Division of Health Licensing will then arrange with the Owner for a site visit prior to patient/client occupancy. Licensing will not visit until the Construction Division has indicated acceptance of construction.

PART 2 - PRODUCTS

2.1 GENERAL

- A. It is the Contractor's responsibility to have the work ready for inspection when requested. Upon completion of the inspections and approval of the work the Contractor shall be prepared to turn the work product over to the Owner.

2.2 DHEC ABOVE-CEILING INSPECTION PUNCHLIST

- A. At the Above-Ceiling inspection the DHEC Inspector may find items that are not satisfactory in either quality or completeness. It will be the Contractor's responsibility to compile the list of deficiencies noted by the Inspector on the attached 017701A DHEC Inspection Punchlist. All deficiencies shall be corrected before the ceiling is allowed to be closed in.
- B. The DHEC Above-Ceiling Inspection punchlist is not to be used as a substitute for the Architect's Above Ceiling Inspection punchlist, which shall be completed prior to the DHEC inspection.

2.3 DHEC COMPLIANCE DOCUMENTATION

- A. DHEC requires compliance documentation to be submitted at the DHEC Final Construction Inspection per Section 017702. The DHEC Inspector will not approve the project without this required documentation. It is the Contractor's responsibility to gather the documents and compile them in a notebook for DHEC review at the DHEC Final Inspection.
- B. Any letters of certification must indicate that the systems "have been tested and found to be operating correctly". It is not acceptable that certification letters only state "the systems have been installed according to code or the documents". Certifications going into the notebook should be copies; the originals go to the Owner.

2.4 DHEC FINAL INSPECTION PUNCHLIST

- A. At the Final inspection the DHEC Inspector may find items that are not satisfactory in either quality or completeness. It will be the Contractor's responsibility to compile the list of deficiencies noted by the Inspector on the attached 017701A DHEC Inspection Punchlist.
- B. The DHEC Final Inspection punchlist is not to be used as a substitute for the Architect's inspection punchlist which shall be completed prior to the DHEC inspection.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall make every attempt to have all the applicable work for each inspection completed and ready to turn over to the Owner prior to the DHEC inspection. If it is obvious that the work is not completed and will not be ready for the inspection, the inspection will be cancelled and rescheduled at the Contractor's expense.

3.2 DHEC ABOVE-CEILING CONSTRUCTION INSPECTION

- A. At least ten (10) days before the Contractor wants the Architect to inspect the above ceiling space, the Contractor shall provide the Architect with a written request.
 - 1. The Architect will schedule the DHEC Above-Ceiling Inspection on the behalf of the contractor.
- B. The Architect shall perform an above-ceiling inspection and create a sign/countersign punchlist.
- C. The Contractor shall correct any outstanding items on the punchlist prior to the DHEC Above-Ceiling inspection and sign the Architect's punchlist to confirm items are complete. The Architect will verify these items with the Contractor and countersign that each item is complete. If it is obvious that the work is not completed, the DHEC inspection shall be cancelled and rescheduled at the Contractor's expense.
- D. At the Above-Ceiling inspection the DHEC Inspector may find items that are not satisfactory in either quality or completeness. It will be the Contractor's responsibility to compile the list of deficiencies noted by the Inspector on the attached 017701A DHEC Inspection Punchlist. All deficiencies shall be corrected before the ceiling is allowed to be closed in.
- E. During the inspection the DHEC inspector may wish to test the systems that were worked on. It is the Contractor's responsibility to have the sub-contractors available for assistance should the systems be tested.
- F. All areas that are part of the inspection shall remain visible and accessible until the entire Above-Ceiling Inspection is finished, the items needing correction have been completed and verified, and the work has been accepted by DHEC.

3.3 DHEC FINAL CONSTRUCTION INSPECTION

- A. At least ten (10) days before the Contractor wants the Architect to perform a Preliminary Inspection, the Contractor shall provide the Architect with a written request to inspect.
- B. The Architect shall perform a Preliminary Inspection and create a sign/countersign punchlist.

1. The Architect will then schedule the DHEC Final Construction Inspection on the behalf of the contractor.
- C. The Contractor shall correct any outstanding items on the punchlist prior to the date of Substantial Completion and sign the Architect's punchlist to confirm items are complete.
- D. On the date of Substantial Completion, the Architect shall perform a Substantial Completion Inspection and generate a Final Punchlist. The Architect will also verify that the work requirements for Substantial Completion have been met. If it is obvious that the work has not been completed, a Certificate of Substantial Completion will not be given and a new Substantial Completion review date will be scheduled at the Contractor's expense. Substantial Completion shall be established and accepted by the Architect prior to the DHEC Final Inspection
- E. DHEC requires compliance documentation to be submitted at the DHEC Final Construction Inspection per Section 017702. The DHEC Inspector will not approve the project without this required documentation. It is the Contractor's responsibility to gather the documents and compile them in a notebook for DHEC review at the DHEC Final Inspection. All documentation shall be reviewed and approved by the Architect and Owner prior to the DHEC Final inspection per Section 017700 "Closeout Procedures".
- F. During the Inspection the DHEC Inspector may wish to test systems included in the Work. It is the Contractor's responsibility to have all sub-contractors available for assistance and provide necessary means for access to inspect and test the Work.
- G. At the Final inspection the DHEC Inspector may find items that are not satisfactory in either quality or completeness. It will be the Contractor's responsibility to compile the list of deficiencies noted by the Inspector on the attached 017701A DHEC Inspection Punchlist. The Inspector will not accept the work until all items are corrected and verified by the sign-countersign method.

END OF SECTION 017701

ATTACHMENTS

The following attachments are also included as part of this specification:

1. 017701A DHEC Inspection Punchlist

Document 017701A - DHEC INSPECTION PUNCHLIST

INSPECTION DATE: _____ **INSPECTION TYPE:** _____

PROJECT NUMBER: _____ **PROJECT NAME:** _____

| NUMBER | ITEM DESCRIPTION | REMARKS | CORRECTED BY (Name/Date) | CHECKED BY (Name/Date) |
|---------------|-------------------------|----------------|-----------------------------------------|---------------------------------------|
| 1) | | | | |
| 2) | | | | |
| 3) | | | | |
| 4) | | | | |
| 5) | | | | |
| 6) | | | | |
| 7) | | | | |
| 8) | | | | |
| 9) | | | | |
| 10) | | | | |
| 11) | | | | |
| 12) | | | | |
| 13) | | | | |
| 14) | | | | |
| 15) | | | | |

SECTION 017702 – MUHA COMPLIANCE CLOSEOUT DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for collecting and submitting required Compliance Documentation
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for inspections and closeout procedures.
 - 2. Section 017701 "DHEC Construction Inspections"

1.3 SUBMITTALS

- A. Compliance Documentation Required for Construction Projects by DHEC, The Joint Commission (TJC), and other regulatory bodies.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Contractor shall assemble MUHA Compliance Close-out Documentation as follows:
 - 1. Hardcopy Binder Format:
 - a. Each hardcopy shall bind the required documentation in heavy-duty, 3-ring, vinyl covered, loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-by-11-inch paper.
 - b. Each binder shall be identified on the front and spine with the typed title "MUHA COMPLIANCE CLOSE-OUT DOCUMENTATION", MUHA Project Name, MUHA Project Number, and Contractor Name. See Attachment 017702A for format.
 - c. Each binder shall have a table of contents document at the front of the book that corresponds to Attachment 017702B. Documents other than those already identified in Attachment 017702B should be included at the end of the table of contents.
 - d. Each binder shall use heavy paper dividers with plastic-covered tabs to divide each section as described in the Table of Contents. Provide a typed description for each tab. Every section described in the Table of Contents shall be included. If a section is not applicable to a project, the section must still be included but indicated as not applicable by placing a document "THIS SECTION NOT APPLICABLE FOR THIS PROJECT" behind the tab for that section. See Attachment 017702C for format.
 - 2. Electronic Format:

- a. Each electronic copy shall organize the required documentation under a main electronic folder named “MUHA COMPLIANCE CLOSE-OUT DOCS - *MUHA Project Number*”.
- b. Within the main electronic folder, sub-folders shall be created for each and every section as described in the Table of Contents. Each sub-folder shall be named with the section number corresponding to the Table of Contents. If a section is not applicable to a project, the sub-folder for that section must still be included but indicated as not applicable by placing a document stating Project Name, Project Number, Table of Contents Number and Name, and “NOT APPLICABLE FOR THIS PROJECT” in the sub-folder. See Attachment 017702C for format.
- c. All documents within the electronic copy of the book shall be in “PDF” format unless approved by the Project Manager in writing.
- d. Each document shall be included as a separate document file, not combined into one PDF file. Each document file shall be named with text such that it is easily understood what information is contained within the file.
- e. The electronic copy of documentation shall be provided on a formatted electronic disc. Each disc shall be identified on the front with the title “MUHA COMPLIANCE CLOSE-OUT DOCUMENTATION”, MUHA Project Name, MUHA Project Number, Contractor Name, and Submittal Date.

B. Minimum Requirements for Documentation: MUHA Compliance Closeout Documentation shall include at a minimum the following documentation as it is applicable to the project:

00 TABLE OF CONTENTS

- Table of Contents as shown in Attachment 017702B. Additional items may be included at end of Table of Contents, if required.

01 DHEC FINAL DOCUMENTATION REQUIRED FOR LICENSURE

- “Final Documentation Required for Licensure” form [obtain from Architect - latest version found on SC DHEC Division of Health Facilities Construction website].

02 DESCRIPTION OF PROJECT

- Written description of project scope. Must be same as description submitted to DHEC during plan review. (obtain from architect).
- List of all contractor companies by craft with addresses, phone, fax, and company’s main contact(s) for project [obtain from Contractor].
- List of all architects / engineering firms with addresses, phone, fax, and firm’s main contact(s) for project [obtain from Architect].

03 DHEC LICENSING APPLICATION

- “Application for License to Operate an Inpatient Care Facility” [obtain from Owner or Architect - latest version found on SC DHEC Division of Health Licensing website].

04 CERTIFICATE OF NEED

- DHEC CON Exemption Letter, if applicable [obtain from Architect or Owner].
- Statement that no DHEC CON review necessary, if applicable [obtain from Architect or Owner].

05 DHEC CONSTRUCTION PROJECT INFORMATION FORM

- Construction Project Information Form [obtain from Architect or Owner – latest version found on SC DHEC Division of Health Facilities Construction].

06 DHEC PLAN ACCEPTANCE LETTER

- DHEC Health Facilities Construction Plan Acceptance Letter [obtain from Architect or Owner]
- Office of State Engineer Construction Document Review Letter [obtain from Architect or Owner]

07 DHEC CONSTRUCTION INSPECTION PUNCH LISTS

- DHEC Construction Above Ceiling Inspection Punch List with Sign / Countersign signatures [obtain from Contractor]
- DHEC Construction Final Inspection Punch List with Sign / Countersign signatures [obtain from Contractor]

08 ARCHITECT INSPECTION / CERTIFICATION

- Architect Certification Letter [obtain from Architect]
- Architect Above Ceiling Punch List with Sign / Countersign signatures [obtain from Contractor or Architect]
- Architect Final Inspection Punch List with Sign / Countersign signatures [obtain from Contractor or Architect]

09 HVAC / MECHANICAL INSPECTION / CERTIFICATION

- Mechanical Engineer HVAC / Mechanical Systems Certification Letter [obtain from Mech. Engr. or Architect]
- Mechanical Engineer Plumbing Certification Letter [obtain from Mech. Engr. or Architect]
- Mechanical Engineer's Final Inspection Punch List with Sign / Countersign signatures [obtain from Contractor or Mech. Engr.]
- Mechanical Engineer's Above Ceiling Punch List with Sign / Countersign signatures [obtain from Contractor or Mech. Engr.]

10 HVAC SYSTEM TEST & BALANCE

- Mechanical Engineer T&B Certification Letter [obtain from Mech. Engr. or Architect]
- Final Typewritten Formal Test & Balance (T&B) Report [obtain from Contractor or Owner if 3rd Party Certification]

11 FIRE & SMOKE DAMPER TESTING

- "Fire & Smoke Damper Testing" (Appendix B) or similar testing verification form [obtain from Contractor]

12 ELECTRICAL INSPECTION / CERTIFICATION

- Electrical Engineer Electrical Systems Certification Letter [obtain from Elect. Engr. or Architect]
- Electrical Engineer's Final Inspection Punch List with sign offs [obtain from Contractor or Elect. Engr.]
- Electrical Engineer's Above Ceiling Punch List with sign offs [obtain from Contractor or Elect. Engr.]
- Isolated Power Systems Certification (Line Isolation Monitors – NFPA 99) [obtain from Contractor or Owner if 3rd Party Certification]
- "Uninterruptible Power Supply (UPS) and Stored Energy Power Supply System (SEPSS) Equipment Matrix" (Appendix B) or similar documentation with same information [obtain from Contractor]
- UPS & SEPSS Manufacturer / Installer Certification of Installation [obtain from Contractor or Manufacturer Representative]

13 FIRE ALARM SYSTEM CERTIFICATION

- Fire Alarm Contractor Certification Letter [obtain from Contractor]
- NFPA-72 Certification Form [obtain from Contractor]
- "Fire Alarm System New Device List" (Appendix B) or similar documentation with same information [obtain from Contractor]

14 SPRINKLER FIRE SUPPRESSION SYSTEM CERTIFICATION

- Mechanical Engineer Sprinkler System Certification Letter [obtain from Mech. Engr. or Architect]

- DHEC State Fire Marshal Sprinkler Plan Approval Letter [obtain from Contractor or Mech. Engr.]
- Mechanical Engineer Fire Protection System Certificate of Compliance (sent with package to DHEC State Fire Marshall) [obtain from Mech. Engr. or Architect]
- Sprinkler Contractor Above Ground Sprinkler System Certification Letter [obtain from Contractor]
- Sprinkler Contractor Below Ground Sprinkler System Certification Letter [obtain from Contractor]
- Sprinkler Specification Sheet [obtain from Mech. Engr.]
- "Fire Suppression System New Device List" (Appendix B) or similar documentation with same information [obtain from Contractor]

15 ALTERNATIVE FIRE SUPPRESSION SYSTEM CERTIFICATION (i.e. FM200, Halon, etc.) – **NOT APPLICABLE**

- Mechanical Engineer Sprinkler System Certification Letter [obtain from Mech. Engr. or Architect]
- Contractor System Installation Certification Letter [obtain from Contractor]
- Extinguishing System Testing Certification [obtain from Contractor]
- "Fire Suppression System New Device List" (Appendix B) or similar documentation with same information [obtain from Contractor]

16 KITCHEN HOOD EXTINGUISHING SYSTEM CERTIFICATION – **NOT APPLICABLE**

- Kitchen Hood Contractor Certification letter [obtain from Contractor]
- Range Hood Systems Inspection Report [obtain from Contractor]
- Extinguishing System Testing Certification [obtain from Contractor]
- "Fire Suppression System New Device List" (Appendix B) or similar documentation with same information [obtain from Contractor]

17 MEDICAL GAS SYSTEM CERTIFICATION– **NOT APPLICABLE**

- Mechanical Engineer Medical Gas System Certification Letter [obtain from Mech. Engr. or Architect]
- Medical Gas Certification Reports [obtain from Contractor or Owner if 3rd Party Certification]

18 NURSE CALL SYSTEM CERTIFICATION– **NOT APPLICABLE**

- Nurse Call Contractor Certification Letter [obtain from Contractor]

19 DIALYSIS WATER SYSTEM CERTIFICATION– **NOT APPLICABLE**

- Dialysis Water Certification [obtain from Contractor or Owner if 3rd party testing].

20 ELEVATOR CERTIFICATION– **NOT APPLICABLE**

- Elevator Contractor Certification Letter [obtain from Contractor]
- DHEC State Inspector Elevator Certification [obtain from Contractor or Owner]
- Elevator Fire Alarm System Integration Testing Certification [obtain from Contractor]

21 EMERGENCY GENERATOR CERTIFICATION– **NOT APPLICABLE**

- Emergency Generator Certification Letter [obtain from Elect. Engr. or Architect]
- (additional commissioning certification documents are also required but not included in this book)

22 FLAME SPREAD / SMOKE DEVELOPMENT DOCUMENTATION

- flame spread and smoke development documentation for finishes (sheetrock, paint, flooring, plastic laminate, fabric, curtains, etc.) and furniture showing that code requirements for space are met. [obtain from Contractor]

23 DOMESTIC WATER TESTING– **NOT APPLICABLE**

- Bacteriological Test Reports [obtain from Contractor or Owner if 3rd party testing]
- Domestic Water Test & Balance Report (temperature verification) [obtain from Contractor or Owner if 3rd party testing]

24 BACK FLOW PREVENTOR CERTIFICATION– **NOT APPLICABLE**

- Back Flow Preventor Certification Form [obtain from Contractor]

25 RADIOLOGICAL EQUIPMENT DOCUMENTATION– **NOT APPLICABLE**

- DHEC Bureau of Radiological Products Shielding Plan Review Letter [obtain from Owner Radiation Officer]
- Equipment Install Certification Letter - certifying equipment was installed per manufacturers guidelines and installation meets all code requirements [obtain from Owner]
- Shielding Plan [obtain from Owner Radiation Officer]
- DHEC Registration of X-Ray Producing Machines Submittal Form [obtain from Owner Radiation Officer]
- DHEC Radiological Health Equipment Log Number (6 Digit xx-xxxx) [obtain from Owner Radiation Officer]

26 DHEC FIRE MARSHAL INSPECTION

- DHEC Fire Marshall Certification [obtain from Architect or Owner]
- DHEC Fire Marshall Inspection Punch List [obtain from Architect or Owner]

27 LOCAL OFFICIALS CERTIFICATE OF OCCUPANCY

- Local Official's Certificate of Occupancy [obtain from Architect or Owner]

PART 3 - EXECUTION

3.1 GENERAL

- A. If Fire or Smoke Dampers are installed on a project, complete Attachment 017702D for each device installed as it is being tested.
- B. If Uninterruptable Power Supplies (UPS) or Stored Energy Power Supply Systems (SEPSS) are installed on a project, complete Attachment 017702E for each device installed.
- C. If new Fire Alarm System devices are installed on a project, complete Attachment 017702F for each device installed.
- D. If new Fire Suppression devices are installed on a project, complete Attachment 017702G for each device installed.
- E. Submit two electronic discs of Preliminary Compliance Documentation (one to Owner and one to Architect) on same day as Architect's Final Inspection is requested (10 days prior to inspection). Owner and Architect will review and return with comments.
- F. Contractor shall incorporate all Architect and Owner comments from preliminary review prior to submittal of Final Compliance Documentation.
- G. Submit two electronic discs of Final Compliance Documentation (one to Owner and one to Architect) on day of Substantial Completion.
- H. Submit three hardcopy binders of Final Compliance Documentation (one to Owner, one to Architect, and one to DHEC Inspector) on day of DHEC Final Inspection.

END OF SECTION 017702

ATTACHMENTS

The following attachments are also included as part of this specification:

1. <17702A COMPLIANCE DOCUMENTATION TITLE PAGE >
2. <17702B TABLE OF CONTENTS >
3. <17702C NOT APPLICABLE FOR THIS PROJECT>
4. <17702D FIRE & SMOKE DAMPER TESTING DOCUMENTATION>
5. <17702E UNINTERRUPTIBLE POWER SUPPLY (UPS) & STORED ENERGY POWER SUPPLY SYSTEM (SEPSS) NEW EQUIPMENT LIST>
6. < 17702F FIRE ALARM SYSTEM NEW DEVICE LIST>
7. < 17702G FIRE SUPPRESSION SYSTEM NEW DEVICE LIST>

MUHA COMPLIANCE CLOSE-OUT DOCUMENTATION

MUHA Project Name:

MUHA Project Number:

Contractor Name:

| <u>SECTION</u> | <u>CONTENTS</u> |
|----------------|---------------------------------------------------|
| 00 | TABLE OF CONTENTS |
| 01 | DHEC FINAL DOCUMENTATION REQUIRED FOR LICENSURE |
| 02 | DESCRIPTION OF PROJECT |
| 03 | DHEC LICENSING APPLICATION |
| 04 | CERTIFICATE OF NEED |
| 05 | DHEC CONSTRUCTION PROJECT INFORMATION FORM |
| 06 | DHEC PLAN ACCEPTANCE LETTER |
| 07 | DHEC CONSTRUCTION INSPECTION PUNCHLISTS |
| 08 | ARCHITECT INSPECTION / CERTIFICATION |
| 09 | HVAC / MECHANICAL INSPECTION / CERTIFICATION |
| 10 | HVAC SYSTEM TEST & BALANCE |
| 11 | FIRE & SMOKE DAMPER TESTING |
| 12 | ELECTRICAL INSPECTION / CERTIFICATION |
| 13 | FIRE ALARM SYSTEM CERTIFICATION |
| 14 | SPRINKLER FIRE SUPPRESSION SYSTEM CERTIFICATION |
| 15 | ALTERNATIVE FIRE SUPPRESSION SYSTEM CERTIFICATION |
| 16 | KITCHEN HOOD EXTINGUISHING SYSTEM CERTIFICATION |
| 17 | MEDICAL GAS SYSTEM CERTIFICATION |
| 18 | NURSE CALL SYSTEM CERTIFICATION |
| 19 | DIALYSIS WATER SYSTEM CERTIFICATION |
| 20 | ELEVATOR CERTIFICATION |
| 21 | EMERGENCY GENERATOR CERTIFICATION |
| 22 | FLAME SPREAD / SMOKE DEVELOPMENT DOCUMENTATION |
| 23 | DOMESTIC WATER TESTING |
| 24 | BACK FLOW PREVENTOR CERTIFICATION |
| 25 | RADIOLOGICAL EQUIPMENT DOCUMENTION |
| 26 | DHEC FIRE MARSHAL INSPECTION |
| 27 | LOCAL OFFICALS CERTIFICATE OF OCCUPANCY |
| 28 | |
| 29 | |
| 30 | |

**THIS SECTION OF THE MUHA
COMPLIANCE CLOSEOUT
DOCUMENTATION IS NOT
APPLICABLE TO THIS PROJECT**

DOCUMENT 017702D - **FIRE & SMOKE DAMPER TESTING DOCUMENTATION**

| <u>DAMPER DESIGNATION</u> | <u>DAMPER LOCATION</u> | <u>FIRE DAMPER OPERATION VERIFIED OK?</u> | <u>SMOKE DAMPER OPERATION VERIFIED OK?</u> | <u>FIRE ALM CLOSES SMOKE DAMPER</u> | <u>TEST PERFORMED BY (PRINT NAME)</u> | <u>COMPANY</u> | <u>DATE TESTED</u> |
|---------------------------|------------------------|-------------------------------------------|--------------------------------------------|-------------------------------------|---------------------------------------|----------------|--------------------|
| _____ | _____ | <input type="checkbox"/> YES | <input type="checkbox"/> YES | <input type="checkbox"/> YES | _____ | _____ | _____ |
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| _____ | _____ | <input type="checkbox"/> YES | <input type="checkbox"/> YES | <input type="checkbox"/> YES | _____ | _____ | _____ |
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| _____ | _____ | <input type="checkbox"/> YES | <input type="checkbox"/> YES | <input type="checkbox"/> YES | _____ | _____ | _____ |

TESTING VERIFIED BY (PRINT NAME) _____ **COMPANY NAME** _____ **DATE VERIFIED** _____

STORM EYE INSTITUTE OPTICAL SHOP
H51-50068

DOCUMENT 017702E - UNINTERRUPTIBLE POWER SUPPLY (UPS) & STORED ENERGY POWER SUPPLY SYSTEM (SEPSS)
NEW EQUIPMENT LIST

| <u>UPS</u> | <u>SEPSS</u> | <u>MANUFACTURER</u> | <u>MODEL NUMBER</u> | <u>SIZE (KVA)</u> | <u>LOCATION</u> | <u>EQUIPMENT SERVED BY UPS OR SEPSS</u> |
|------------|--------------|---------------------|---------------------|-------------------|-----------------|---------------------------------------------|
|------------|--------------|---------------------|---------------------|-------------------|-----------------|---------------------------------------------|

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

- a. Name each indexed document file in composite electronic index with applicable item name. Arrange in numerical order by specification section number. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 10 days before A/E inspection. Architect and Commissioning Authority will review general scope and content of manual and respond with deficiencies by date of A/E Punchlist Inspection.
1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments.
- D. Final Manual Submittal: Submit each manual in final form with required revisions prior to Substantial Completion.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.

3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Architect.
 7. Name and contact information for Commissioning Authority.
 8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single electronic folder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment

included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.

3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.

4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.

2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions as modified by the Owner and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 014240 - MUHA Documentation Standards.
 - 2. Section 017300 "Execution" for final property survey.
 - 3. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 5. Section 017900 "Demonstration and Training" for documentation of operation and maintenance training.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Submit PDF electronic files of scanned marked-up record prints and one paper-copy set(s) of marked-up record prints to Architect and Owner.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications to Architect.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal to Architect.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal to Architect.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings on Project site, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 7. Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file .

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition,

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protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

- B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove any items they intend to keep. All items remaining at time of Notice to Proceed, except those noted to be removed by Contractor and turned over to the Owner, shall be the Contractor's responsibility.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.
- B. Contractor shall coordinate trash removal path in existing building with the Owner, prior to start of the work. The Contractor shall be responsible for all dumpsters, hauling, disposal, etc.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches. Consult with Owner prior to use for approval, procedures, fire suppression, and requirements that must be met before the Owner will consider any request to use torches.
 - 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Coordinate with the Owner prior to start of demolition activities.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

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

END OF SECTION

SECTION 035416 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.3 ALLOWANCES

- A. Provide hydraulic cement underlayment as part of underlayment allowance – see specification section 012100 “Allowances”.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).

PART 2 - PRODUCTS

2.1 HYDRAULIC CEMENT UNDERLAYMENTS

- A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch (6 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Basis-of-Design Products. Subject to compliance with requirements, provide Ardcx: K-15 Self-Leveling Underlayment Concrete. Similar products by one of the following may be accepted with prior approval:
 - a. BASF Construction Chemicals, Inc.
 - b. Bonsal American, an Oldcastle company
 - c. MAPEI Corporation
 - d. USG Corporation
 - 2. Cement Binder: ASTM C 150/C 150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 - 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.
 - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
- E. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment. Contractor shall verify with floor finish manufacturer for compatibility.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m) in 24 hours.
- C. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.
- D. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.
- E. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 - 2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
 - 1. Apply a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Apply surface sealer at rate recommended by manufacturer.
- G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035416

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Joints in or between fire-resistance-rated constructions.

- B. Related Requirements:

- 1. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

- 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. Hilti, Inc.
 - c. Nelson Firestop; a brand of Emerson Industrial Automation.
 - d. Thermafiber, Inc.; an Owens Corning company.
 - e. Tremco, Inc.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.

2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.

3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or

deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- B. Head-of-Wall, Fire-Resistive Joint Firestopping Systems FRJS:
 - 1. UL-Classified Systems: HW-D-0042.
 - 2. Assembly Rating: 1 hour, 2 hours.
 - 3. Joint Width: 1" maximum.
 - 4. Movement Capabilities: Class II - 50 percent compression or extension.

END OF SECTION 078443

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Mildew-resistant joint sealants.
 - 5. Butyl joint sealants.
 - 6. Latex joint sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, 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 joint-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 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) Dow Corning Corporation.
 - b) GE Construction Sealants; Momentive Performance Materials Inc.
 - c) May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d) Pecora Corporation.
 - e) Sika Corporation: Joint Sealants.
- B. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) Dow Corning Corporation.
 - b) GE Construction Sealants; Momentive Performance Materials Inc.
 - c) Polymeric Systems, Inc.
 - d) Sherwin-Williams Company (The).

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) Dow Corning Corporation.
 - b) GE Construction Sealants; Momentive Performance Materials Inc.
 - c) May National Associates, Inc.; a subsidiary of Sika Corporation.

- d) Percora Corporation.
- e) Sika Corporation; Joint Sealants.
- f) Tremco Incorporated.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) BASF Corporation; Construction Systems.
 - b) Bostik, Inc.
 - c) Percora Corporation.
 - d) Polymeric Systems, Inc.
 - e) Sherwin-Williams Company (The).
 - f) Sika Corporation; Joint Sealants.
 - g) Tremco Incorporated.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) Dow Corning Corporation.
 - b) GE Construction Sealants; Momentive Performance Materials Inc.
 - c) May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d) Tremco Incorporated.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) Bostik, Inc.
 - b) Pecora Corporation.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) BASF Corporation; Construction Systems.
 - b) May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c) Pecora Corporation.
 - d) Sherwin-Williams Company (The).
 - e) Tremco Incorporated.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - f) BASF Corporation; Construction Systems.
 - g) Construction Foam Products; a division on Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. 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. Provide self-adhesive tape where applicable.

2.9 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 performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - e. Cementitious siding & trim.
 - 3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth,

uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise

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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-1.
 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry, walls and partitions.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement JS-2.
 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Acrylic latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-3.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Concealed mastics JS-4.
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Butyl-rubber based.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 081113 - HOLLOW METAL 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 doors in hollow metal frames.

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.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door frame type.
 - 2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 3. Locations of reinforcement and preparations for hardware.
 - 4. Details of each different wall opening condition.

5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 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 the specifications, provide frames by one of the following:
1. Ceco Door; ASSA ABLOY.
 2. Curries Company; ASSA ABLOY.
 3. Republic Doors and Frames.
 4. Steelcraft; an Allegion brand.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR FRAMES

- A. Construct frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - a. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.4 BORROWED LITES

- A. Hollow-metal frames of metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
- B. Construction: Full profile welded.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 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), 04Z (12G) 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."

2.7 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 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. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. 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.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 6. 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.
- C. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- D. 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.
- E. 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. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 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.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

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 for doors, transoms, sidelites, borrowed lites, and other openings, 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. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check 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. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 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 (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. 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 (230 mm) o.c. and not more than 2 inches (51 mm) 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. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Section 088810 "Fire Rated Glass and Framing System" for glass view panels in rated flush wood doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.

- C. Samples for Initial Selection: For factory-finished doors.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.
- B. **Vendor Qualifications:** A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. **Environmental Limitations:** Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during remainder of construction period.

1.8 WARRANTY

- A. **A. Special Warranty:** Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. Algoma Hardwoods, Inc.

2. Eggers Industries.
3. Graham Wood Doors; ASSA ABLOY Group Company.
4. Mohawk Flush Doors, Inc.
5. VT Industries Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
- D. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
1. Grade: Custom (Grade A faces).
 2. Species: For bidding purposes assume White Oak, stained to match existing adjacent doors. Final species to be determined during submittal process.
 3. Cut: plain sliced.
 4. Match between Veneer Leaves: Slip match.
 5. Assembly of Veneer Leaves on Door Faces: Center Balance match.
 6. Exposed Vertical and Top Edges: Same species as faces or a compatible species - edge Type A.
 7. Core: Either glued wood stave or structural composite lumber.
 8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Recessed tapered beads.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 - 1. Grade: Custom.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.

3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Filled finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 1. Install fire-rated doors according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 084126 – BUTT GLAZED STOREFRONT SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior aluminum frames.

1.2 RELATED SECTIONS

- A. Section 088000 - Glazing.

1.3 REFERENCES

- A. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.
- D. UL 10C (2015) / NFPA 252 – 20 Minute Fire Test of Door Assemblies

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

1.5 SUBMITTALS

- A. Comply with Section 013300 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.
- C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, hardware schedule, glazing, and finish.
- D. Samples:
 - 1. Frames: Submit manufacturer's sample of framing, hardware, glazing, and finish.
 - 2. Color: Submit manufacturer's samples of standard colors of doors and frames.
- E. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.
- G. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Continuously engaged in manufacturing of frames of similar type to that specified, with a minimum of 30 years successful experience.
 - 3. Evidence of a compliant documented quality management system.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening mark and manufacturer.
- B. Package no more than one frame per box.
- C. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- D. Handling: Protect materials and finish from damage during handling and installation.

1.8 WARRANTY

- A. Warrant frames against failure in materials and workmanship, including excessive deflection, faulty operation and deterioration of finish or construction.
- B. Frame Warranty Period: One year starting on date of shipment.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531. Phone (269) 423-7068. Fax (800) 423-7610. Web Site www.special-lite.com. E-Mail info@special-lite.com, or similar product by one of the following:
 - a. US Aluminum, CR Laurence, Clear View Series Frameless Glass Wall Office System.
 - b. Infinium Walls, 22555 Ascoa Court, Strongsville, OH, 44149 PHONE: 440.572.5000, <http://infiniumwalls.com>

2.2 INTERIOR ALUMINUM FRAMES

- A. Type: Type II Framing System Rectilinear design.
- C. Throat Size: 3-3/4"
- D. Trim Size: 2"
- F. Corners and Joints: Provide galvanized steel reinforcing clips.
- H. Aluminum Members:
 - 1. Aluminum extrusions made from prime-equivalent billet that is produced from 100% re-processed 6063-T6 alloy recovered from industrial processes: ASTM B 221.

2. Sheet and Plate: ASTM B 209.
3. Wall Thickness: 0.062 inch.

I. Frame Glazing

1. Factory Glazing: 3/8-inch glass
2. Vinyl Glazing: Grey or black to match extrusion color.
3. Design glazing system for replacement of glass.
4. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

- A. Install frames in accordance with manufacturer's instructions.
- B. Install frames plumb, level, square, true to line, and without warp or rack.
- C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- D. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of frames.

3.5 CLEANING

- A. Clean frames promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

STORM EYE INSTITUTE OPTICAL SHOP
H51-50068

- A. Protect installed frames to ensure that frames will be without damage or deterioration at time of substantial completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Definition: "Finish Hardware" includes items known commercially as finish / security hardware and systems which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.
- B. Extent of finish / electrified hardware required is indicated on drawings and in schedules.
- C. Types of finish hardware required include, but are not limited to, the following:

- Butt Hinges/Continuous Hinges
- Lock cylinders and keys
- Lock and latch sets
- Closers
- Protection plates
- Smoke Gaskets

- D. References

- NFPA-80 – Standard for Fire Doors and Windows as adopted.
- NFPA-101 – Life Safety Code as adopted
- NFPA – 70 – National Electric Code s adopted
- ADA – The Americans with Disabilities Act – Title III – Public Accommodations
- ANSI-A 117.1-American National Standards Institute – Accessible and Usable Buildings and Facilities
- ANSI-A156.5-American National Standards Institute – Auxiliary Locks and Associated Products
- International Building Code as Adopted
- Positive Pressure Testing UL10C & UBC7.2
- UL - Underwriters Laboratories
- WHI – Warnock Hersey International, Division of Inchscape Testing Services
- State, Local and Federal Codes, National Electrical Building Codes, including the Authority Having Jurisdiction

1.3 RELATED WORK

- A. Steel Doors and Frames - Section 08110.
- B. Flush Wood Doors - Section 08210.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Obtain each type of hardware (ie lock sets) from a single manufacturer, although several may be indicated as offering products complying with requirements.

- B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the project's vicinity for a period of not less than 4 years. The supplier shall be, or shall employ, a certified Architectural Hardware Consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to the Owner, Architect and the Contractor. The certified architectural hardware consultant (AHC) shall prepare all hardware and wiring diagrams. This Supplier is responsible for proper coordination of all finished hardware with related sections to insure compatibility of products.
- C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware, which has been tested and listed by UL / WHI or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Provide door seals to meet Positive Pressure Testing UL10C and UBC7 – 2 as required.
- D. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL / WHI or FM label on exit devices indicating "Fire Exit Hardware".
- E. Thru-bolt door closers and exit devices as standard application. **Verify and coordinate with the MUSC Project Manger.** If solid blocking is specified in the wood door specification, thru-bolts may not be required for hardware attachment in these doors.
- F. Unless otherwise specified, provide lever handle locksets ADA compliant.
- G. Pre-Installation Meeting: The Contractor shall initiate and conduct a jobsite meeting with the hardware supplier and the Installer, and all related trades for mechanical and electrical hardware. This meeting shall convene at least one month prior to commencement of the related work, specifically, the electrical rough-in for coordination of electrified hardware applications. All approved shop drawings, wiring diagrams, and schedules shall be made available to all related trades as required for work to be performed. The Owner's representative shall attend all pre-install meetings. In addition to reviewing and the coordinating the applications, the hardware supplier shall, with the assistance of the manufacturer's representative, provide a review and training to the Installers of the following products prior to installation of these products: closers, exit devices, locks, and electrified hardware. The Hardware Supplier shall provide a written certificate of attendance to the Installers at the training. The Hardware Supplier shall provide the Contractor the names of the training attendees.
- H. Keying Meeting: A keying conference shall be conducted following the approval of all hardware submittals on each MUSC construction project where new locks and/or cylinders are being furnished. Attendance to this meeting shall be: Project Architect, MUSC Project Manager, MUSC Locksmith, the Hardware Supplier, and any Owner requested user.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.
- B. Hardware Schedule: Submit five copies of schedule in accordance with Division 1 – "Submittals", General Requirements. Schedule to be in vertical format, listing each door opening, including: Keying Information, handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door openings as intended, and finish of hardware. At doors with door closers or door controls, include degree of door opening. All submittals (schedules, cut sheets, diagrams) shall be reviewed by the MUSC project manager prior to ordering of material. Supply the schedules and all templates within two (2) weeks from date purchase order is received by the door openings supplier. Furnish wiring diagrams (elevation, riser) for all electrified hardware.
1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into a vertical format with "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
- a. Type, style, function, size and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of hardware set cross-referenced to indications on
 - e. Drawings both on floor plans and in door and frame schedule.
 - f. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
 - g. Mounting locations for hardware.
 - h. Door and frame sizes and materials.
 - i. Keying information.
 - j. Describe door operation function with the electrified hardware.
- C. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames), which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- D. Keying Schedule: Owner will self-perform keying.
- E. Samples if Requested: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit any requested samples of type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.
- F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location, coordination and installation of hardware.

G. Manufacturer's Catalog Cuts: Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

1.6 PRODUCT HANDLING

- A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Inventory hardware jointly with the General Contractor, representatives of hardware supplier / hardware installer until each is satisfied that count is correct.
- C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- D. The General Contractor shall provide secure lock-up for hardware and security equipment delivered to the project, but not yet installed. Control handling and installation of hardware items, which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.7 SEQUENCING AND SCHEDULING

- A. Deliver all finish hardware to the job site in a timely manner so not to delay progress of other trades.

1.8 WARRANTY

- A. Provide manufacturers' warranties as follows:
 - 1. Hinges: Life of the Building.
 - 2. Mortise Locksets: 3-year warranty, minimum, against manufacturing defects and workmanship.
 - 3. Door Closers: 30-year warranty, minimum, against manufacturing defects and workmanship.
 - 4. Exit Devices: 3-year warranty, minimum, against manufacturing defects and workmanship.
 - 5. Balance of items shall carry a manufacturer's 1-year warranty against manufacturing defects and workmanship.

B. During the warranty period, replace defective product, including labor, materials, and other costs incidental to the work. Upon written notice from the MUSC Project Manger, the Contractor and the Hardware Supplier shall inspect the work within 24 hours after completion, and provide written receipt of completion of the warranty work to the MUSC Project Manager .

PART 2 - PRODUCTS

2.1 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Hardware Sets at the end of this section. Products are identified by using hardware designation numbers of the following:

| <u>Hardware Item:</u> | <u>Specified Manufacturer</u> | <u>Designation</u> |
|-----------------------|-------------------------------|--------------------|
| Butts: | Ives | IVE |
| Locksets: | Schlage | SCH |
| Cylinders/Cores | Best | BES |
| Panic Hardware | Von Duprin | VON |
| Silencers: | Ives | IVE |
| Stops: | Ives | IVE |
| Closers: | LCN | LCN |
| Pulls | Ives | IVE |

B. Provide products as hereafter specified. Substitutions other than those manufacturers listed, must be approved, in writing, via addenda, prior to bid. Procedure for substitutions shall be as outlined in Division 1. No substitutions will considered after award of contract.

2.2 MATERIALS AND FABRICATION

A. General:

1. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Architect.
3. Manufacturer's identification will be permitted on rim of lock cylinders only.
4. Finishes:
 - a. 626/652 for all finished metal hardware items except as 630 is otherwise indicated. Door closers to be powder coated to match 652/626. Exit devices to be US26D with stainless steel touchbars.
5. Lockset Design: Lever handle design shall be "LWA" for mortise locks.
6. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware, which has been prepared for self-tapping sheet metal screws, except, as specifically indicated.
7. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
8. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Use thru-bolts for closer and exit devices. Coordinate wood door blocking at all wood doors and all fire rated wood doors. Provide sleeves for each thru-bolt or use sex screw fasteners.
9. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.3 HINGES AND BUTTS

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Screws: Furnish Phillips flat-head or machine screws for installation of units, except furnish Phillips flat-head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Steel Hinges: Steel pins.
 - 2. Non-ferrous Hinges: Stainless steel pins.
 - 3. Exterior Doors: Non-removable pins.
 - 4. Out-swing Corridor Doors: Non-removable pins.
 - 5. Interior Doors: Non-rising pins.
 - 6. Tips: Flat button
 - 7. Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

2.4 LOCK CYLINDERS AND KEYING

- A. Equip locks and cylinders with cylinders for interchangeable core, 7-pin housings with construction cores as specified. All cylinders and cores shall be by Best x "F" keyway. The blanks shall be stamped: "Do Not Duplicate". All permanent cores/cylinders and keys shall be shipped directly to the Owner from the factory. Verify all keying requirements with the MUSC Lock Shop prior to ordering the Best cylinders and cores.
- D. Furnish temporary Construction Keyed cores for the duration of the construction period. Construction cores shall not part of the Owner's existing key system. The MUSC Lock Shop shall install the permanent keyed cores.
- E. Equip locks with cylinders that comply with performance requirements for Grade 1 cylinders as listed in ANSI A156, and are UL-listed.
- F. Bitting List: Not required.
- G. Key Quantity/ Extra s:
 - 5 each extra cores x 2 each key blanks
 - Permanent keys: Allow 2 each key blanks keys per lock

2.5 LOCKS, LATCHES AND BOLTS

- A. Locksets shall be as specified: Mortise type lockset shall be Series 1000, Grade 1 Operational and Security, UL Listed for 3-hour fire door. Approved manufacturers: Corbin-Russwin ML2000 series. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with ANSI curved lip extended to protect frame, finished to match hardware set. Where specified, provide a vandal resistant trim. At single toilet rooms specify privacy as ML2060 function. Electrified mortise locks shall be

“EU”, electric unlock. **The Hardware Supplier shall verify the lock and the lock trim included on existing doors adjacent to/included in the new project work, and advise the GC and Architect if different from the trim style specified in the attached Hardware Sets.**

- B. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
- C. Lock Throw: Provide solid stainless steel 1 ½” deadbolt with 1" minimum throw. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
- D. Provide ¾" minimum throw on latch bolts.
- E. Flush Bolt Heads: Minimum of ½" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.

2.6 EXIT DEVICES

- A. General: All devices shall be of one manufacturer to provide for proper installation and servicing. Devices shall be furnished non-handed and capable of direct field conversion for all available trim functions. All devices shall carry a three year warranty against manufacturing defects and workmanship. All devices shall be either narrow-stile cross-bar type or push-through touch pad design as specified. No exposed touch bar fasteners, no exposed cavities when operated.
- B. Furnish all touch-pad type devices with stainless steel touch bars. Plastic parts are not acceptable.
- C. Furnish all touch-pad type exit devices with deadlocking latch bolts. Latchbolts shall be moly-coated to reduce friction against the strike.
- D. Furnish all touch-pad exit devices with heavy duty cast metal end caps, flush with device housing..
- E. Furnish roller strikes with all rim exit devices.
- F. Furnish stabilizers similar to Von Duprin 154 with all removable mullions.
- G. Outside Trim: Shall be heavy duty type and fastened by means of concealed welded lugs and thru-bolts from the inside. Trim shall be forged brass with a minimum average thickness on the escutcheon of .130. Plate with trim shall be brass with minimum average thickness of .090 and have forged pulls. Where Lever Handles are specified provide 996 type Break Away Trim. Where outside trim is specified, furnish trim that thru-bolts directly to the exit device center case.
- H. Furnish cylinders with all lockable exit devices. Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.
- I. Furnish required filler plates and shim kits for flush mounting of exit devices on all doors requiring same.

J. Springs: Compression type only. Torsion springs are not acceptable.

K. The preferred exit device: Von Duprin 35A/98 series. Electrified devices shall include the QEL feature at all rim-mounted applications.

L. Exit devices shall be furnished with thru-bolts.

M. At classroom or meeting rooms with panic hardware, include an inside –thumb-turn cylinder with indicator as “2SI”.

2.7 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.

B. Closers: All door closers shall be of one manufacturer to provide for proper installation and servicing after installation. All closers shall be inspected after installation by a factory representative to ensure proper adjustment and operation. A report shall be filed with the architect after said visit has been made. Closer shall carry a manufacturer's 30-YEAR WARRANTY for hydraulic units and 2 year warranty for electrical and/or handicap power assist door closers against manufacturing defects and workmanship. All closers shall be high strength cast iron with one piece forged steel piston. PRV [pressure relief valves] are not acceptable.

C. Parallel Arm Closers: Shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" x 1/2" steel stud shoulder bolts, shall be incorporated in regular arms, hold open arms, arms with stop built in, arms with hold open and stop built in. All other closers shall have forged steel main arms for strength, and durability.

D. Built-In Stops: Where closers with built-in positive stops are used, the stops shall be of one piece cast malleable iron material with built in springs. Where required, the hold-open assembly handle for these stops shall rotate on ball bearings.

E. All door closers shall pass UL10C positive pressure fire test.

F. Non-sized and specific to door mounting: All exterior closers shall be non-sized to provide a full range of Size 1 to 5 closing power, and shall be handed.

G. Hydraulic Fluid: All closers, with the exception of interior electronic closers, shall utilize temperature stable fluid capable of withstanding temperature ranges of 120 degrees F. to -30F. without requiring seasonal adjustment of closer speed to properly close the door. Fluid shall be nonflammable.

H. All closers shall have a powder coat finish on closer body, arm, cover and adapter plate. Furnish special rust inhibiting pre-treat coating, as specified, for closer body, arm, cover and plates before the powder coat finish.

I. Provide all drop plates, shoe supports, templates, etc. to properly mount closers according to manufacturers' recommendations.

J. The preferred manufacturer: LCN 4111/4011. Acceptable manufacturers: Sargent 281 series; Corbin-Russwin DC8200 series.

K. Closers shall be thru-bolt mounted, unless otherwise directed.

2.8 EXIT DEVICES

A. General: All devices shall be of one manufacturer to provide for proper installation and servicing. Devices shall be furnished non-handed and capable of direct field conversion for all available trim functions. All devices shall carry a three year warranty against manufacturing defects and workmanship. All devices shall be either narrow-stile cross-bar type or push-through touch pad design as specified. No exposed touch bar fasteners, no exposed cavities when operated.

B. Furnish all touch-pad type devices with stainless steel touch bars. Plastic parts are not acceptable.

C. Furnish all touch-pad type exit devices with deadlocking latch bolts. Latchbolts shall be moly-coated to reduce friction against the strike.

D. Furnish all touch-pad exit devices with heavy duty cast metal end caps, flush with device housing..

E. Furnish roller strikes with all rim exit devices.

F. Furnish stabilizers similar to Von Duprin 154 with all removable mullions.

G. Outside Trim: Shall be heavy duty type and fastened by means of concealed welded lugs and thru-bolts from the inside. Trim shall be forged brass with a minimum average thickness on the escutcheon of .130. Plate with trim shall be brass with minimum average thickness of .090 and have forged pulls. Where Lever Handles are specified provide 996 type Break Away Trim. Where outside trim is specified, furnish trim that thru-bolts directly to the exit device center case.

H. Furnish cylinders with all lockable exit devices. Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.

I. Furnish required filler plates and shim kits for flush mounting of exit devices on all doors requiring same.

J. Springs: Compression type only. Torsion springs are not acceptable.

K. The preferred exit device: Von Duprin 35A/98 series. Electrified devices shall include the QEL feature at all rim-mounted applications.

D. Exit devices shall be furnished with thru-bolts.

- E. Acceptable exit device applications: Rim and Surface Vertical Rod. Removable Mullions are not acceptable, unless it is the only approved application for a fire rated pair of doors.

2.9 DOOR TRIM UNITS

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops and similar units); either machine screws or self-tapping screws.
- B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.
- C. Fabricate protection plates (armor, kick or mop) not more than 2" less than door width on stop side and not more than 1" less than door width on pull side, x the height indicated.
- C. Metal Plates: Stainless steel, .050" (U.S. 18 ga), beveled 3 edges: top and both sides.

2.10 GASKETS, DOOR BOTTOMS

- A. General: Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf, except where stated the door manufacturer will provide the weatherstripping.. Provide type, sizes and profiles shown or scheduled. Provide non-corrosive fasteners as recommended by manufacturer for application indicated. All gaskets for fire label doors shall comply the door manufacturers label approvals. Fire-label wood doors shall be furnished as "Category A" type with the intumescent seal, integrated into the door construction.

2.11 THRESHOLDS

- A. General: Except as otherwise indicated provide standard aluminum threshold unit of type, size and profile as shown or scheduled.
- B. Provide thresholds that are 1" wider than depth of frame.
- C. **Provide thresholds with return closed ends where specified in Hardware Sets.**

2.12 DOOR SILENCERS

- A. All hollow metal frames shall have gray resilient type silencers. Quantity (3) on single doors and quantity (2) on pair of doors.

2.13 MISCELLANEOUS

- A. Coat Hook: Provide one (1) each coat hook at each office door. Coat hook shall be as Ives #572.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces, which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- C. Drill and countersink units, which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- D. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.
- E. Adjust and reinforce attachment substrate for proper installation and operation:
 - Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc.
- F. Locate floor stops not more than 4 inches from the wall.
- G. Install closers and exit devices with the manufacturer's provided thru-bolts. Verify this mounting with the architect and the Owner.
- H. Certified Installers: Prior to installation of Locksets, Closers, and Exit Devices, hardware installers shall be trained by the manufacturers' representative of each product. This training shall be conducted during the Pre-Installation Meeting at the project site.

3.2 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units, which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

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D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

D. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative[s] of the Finish Hardware manufacturer[s], shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items, which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of all current or predictable problems (of substantial nature) in the performance of the hardware and furnish copy to Owners Agent / Representative.

3.3 HARDWARE SETS AS FOLLOWS:

HARDWARE GROUP NO. 01

FOR USE ON MARK/DOOR #(S):

01

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|-------------------|----------------|--------|-----|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PASSAGE SET | L9010 03A | 626 | SCH |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | COAT AND HAT HOOK | 575 | 673 | IVE |

HARDWARE GROUP NO. 02

FOR USE ON MARK/DOOR #(S):

02

EACH TO HAVE:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|-----|--------------------|---------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112HD | 628 | IVE |
| 1 | EA | MORTISE CYLINDER | 1E72 | 626 | BES |
| 1 | EA | FIRE EXIT HARDWARE | 35A-L-F-360-03 4' DOOR | 626 | VON |
| 1 | EA | SURFACE CLOSER | 4111 SCUSH | 689 | LCN |
| 1 | EA | PA MOUNTING PLATE | 4110-18PA | 689 | LCN |
| 1 | EA | CUSH SHOE SUPPORT | 4110-30 | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | SET | SMOKE/FIRE GASKET | BY THE FIRE DOOR MFGR | | |

1. THE GC & THE HW SUPPLIER SHALL COORDINATE THE HARDWARE REQUIREMENTS WITH THE SAFTI-FIRST FIRE-RATED GLASS DOOR MFGR. NOTIFY THE ARCHITECT OF ANY EXCEPTIONS TO THE SPECIFIED HARDWARE PRIOR TO ORDERING THE DOOR HARDWARE.

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HARDWARE GROUP NO. 03 - POCKET DOOR

FOR USE ON MARK/DOOR #(S):

03

EACH TO HAVE:

| QTY | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-------|-----------------|----------------|---------|-----|
| 1 SET | POCKET DOOR KIT | 9850-96 | AL | HAG |
| 1 EA | LONG DOOR PULL | PR 9266F 12" N | 630-316 | IVE |

ORDER AS A PAIR FOR MOUNTING

End Section 8710

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. Section includes:
 - 1. Glass for windows, doors, interior borrowed lites, storefront framing.
 - 2. Glazing sealants and accessories.
- B. Related Requirements:
 - 1. Section 088813 "Fire-Resistant Glazing."

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to 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. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to 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.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
1. Guardian Industries
 2. Cardinal Glass Industries
 3. Oldcastle
 4. Pilkington
 5. PPG
 6. Viracon
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain tinted glass from single source from single manufacturer.
 2. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
 - 2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they 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. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with 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 of 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 fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, 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 systems.
 3. Minimum required face and 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.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 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 (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

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, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to 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. Installation with Drive-in Wedge Gaskets: 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. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-01 (088000.A): Clear fully tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing required.

END OF SECTION 088000

SECTION 08 8810: FIRE RATED GLASS and FRAMING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Fire rated glazing and framing for a complete UL rated assembly.
 - 1. Fire resistive, safety rated glazing material for interior applications
 - 2. Applications of fire rated glazing includes:
 - a. Fire rated glazing in transparent wall applications in butt-glazed assemblies.
- B. Related sections:
 - 1. Section 013300: SUBMITTAL PROCUEDURES for Shop Drawings, Product Data and Samples.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E119: Methods for Fire Tests of Building Construction and Materials.
- C. Underwrites Laboratories, Inc. (UL):
 - 1. UL 263: Fire Tests of Building Construction and Materials.
- D. Standard Council of Canada:
 - 1. ULC Standard CAN4-S101: Fire Tests of Building Construction and Materials.
- E. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
- F. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1: Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- G. Glass Association of North America (GANA)
 - 1. GANA – Glazing Manual.
 - 2. FGMA – Sealant Manual.
- H. International Building Code (IBC) 2015

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide a fire rated glazing manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.
 - 1. Fire Rating: 60-120 minutes with hose stream.
 - 2. Fire resistive, safety rated glazing tested in accordance with ASTM E119, ANSI/UL 263.

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3. Testing Laboratory: Fire test shall be conducted by a nationally recognized independent testing laboratory.

B. Listings and Labels:

1. Fire rated glazing shall be under current follow-up services by a nationally recognized independent testing laboratory approved by OSHA and maintain a current listing or certification. Assemblies shall be labeled in accordance with limits of listings.

1.04 SUBMITTALS

A. Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedure Section.

1. Shop Drawings: Submit shop drawings showing layouts, profiles and product components.
2. Samples: Submit 12x12 glass samples.
3. Technical Information: Submit latest edition of manufacturer's product data.

1.05 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials to specified destinations in manufacturer or distributor's packaging.

D. Storage and Protection: Store off ground, under cover, protected from weather and construction activities and at temperature conditions recommended by manufacturer.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements for openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.07 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document. Manufacturer's warranty is not intended to limit other rights that the Owner may have under the Contract Documents.

1. Warranty Period: 5 years from date of shipping.

PART 2 PRODUCTS

2.01 FIRE RATED GLAZING ASSEMBLY

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- A. Basis of Design Manufacturer: SuperLite™ II-XLB and GPX Architectural Series Framing as manufactured and distributed by SAFTI *FIRST*.
1. Contact: 100 N Hill Drive, Suite 12, Brisbane, CA 94005; Telephone 888.653.3333; Fax 888.653.4444; email info@safti.com; Web site www.safti.com.
 2. Fire rated glass and framing must be provided by a single-source, US manufacturer. Distributors of fire rated glass and framing are not to be considered as manufacturers.
 3. Subject to compliance similar products by one of the following will be considered:
 - a. Vetrotech Saint-Gobain, Contraflam Structure Butt-joint glazing system, www.vetrotech.com
 - b. AluFlam Fire Rated Aluminum Window and Door Systems, www.alumflam-usa.com

C. Design Requirements:

1. Glass Make-up: Comprised of multiple lites of [clear tempered] [Starphire® Ultra-Clear Low-Iron Tempered Glass by PPG] with clear, fire resistive, intumescent interlayers in between.
2. Glass Thickness: 2-1/2"
3. Glass Weight: approx. 15 lbs./sq. ft.
4. Frame Profile: 2-1/2"
5. Frame Finishes: High performance fluoropolymer finishes by PPG.
 - a. Color to be selected by Architect from manufacturers full range.
- b. Dimensions: Must meet max. clear view area of 7,980 sq. in. not to exceed 133" in clear view height or width. Butt-glazed option available.
- c. Appearance: Must be tint-free, optically clear fire rated glazing.
- d. Fire Rating: Must be fire rated to 60-120 minutes with hose stream and meet ASTM E-119, ANSI/UL263, ULC CAN4-S101.
- e. Impact Safety Resistance: CPSC 16 CFR 1201 Cat. I & II.

D. Manufacturer's Fire Rated Glazing Material:

1. Each piece of fire-rated glazing material shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.
2. Glazing materials installed in Hazardous Locations, subject to human impact, shall be certified and permanently labeled as meeting applicable requirements reference in NFPA 80:
 - a. CPSC 16 CFR 1201 Cat. I & II
 - b. ANSI Z97.1 Class A

2.02 MATERIALS

A. Glazing Accessories: Manufacturer recommended fire rated glazing accessory as follows:

1. Glazing with EPDM tape or other listed flame resistant gasket material and calcium silicate setting blocks.

2.04 SOURCE QUALITY

A. Obtain fire rated glazing products from a single manufacturer.

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- B. Fabrication Dimensions: Fabricate to approved dimensions. The general contractor shall guarantee dimensions where practicable within required tolerances.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data including product technical bulletins and installation instructions.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, have been previously installed under other sections, and are acceptable for product installation in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Installation shall be in strict accordance with the fire glazing material manufacturer's specifications. Field cutting or tampering is strictly prohibited.

3.04 CLEANING AND PROTECTION

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove such substances by method approved by manufacturer.
- B. Wash glass on both faces not more than four days prior to date schedule for inspections intended to establish date of Substantial Completion. Wash glass by method recommended by glass manufacturer.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

SECTION 088813 - FIRE-RESISTANT GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection-rated glazing.
 - 2. Fire-resistance-rated glazing.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches (300 mm) square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to 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. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Permanently mark glazing with certification label of THE Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
 - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.
- C. Fire-Protection-Rated Tempered Glass: 6-mm thickness, fire-protection-rated tempered glass; and complying with 16 CFR 1201, Category II.

1. AGC Glass Co.
 2. SAFTI First
 3. Technical Glass Products
 4. Vetrotech Saint-Gobain
- D. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.
1. AGC Glass Co.
 2. Pilkington
 3. Technical Glass Products
 4. Vetrotech Saint-Gobain

2.6 FIRE-RESISTANCE-RATED GLAZING

- A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E 119 or UL 263.
- B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.
- C. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.
1. AGC Glass Co.
 2. Pilkington
 3. Technical Glass Products
 4. Vetrotech Saint-Gobain

2.7 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
 - 1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 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. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- 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 (1270 mm).
 - 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 (3-mm) 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 with proper orientation so that coatings face fire side or protected side as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to 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. Installation with Drive-in Wedge Gaskets: 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.
- 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. 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 washaway from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 FIRE-PROTECTION-RATED GLAZING SCHEDULE

- A. Glass Type FPGL-1: 20-minute fire-protection-rated glazing without hose-stream test; fire-protection-rated tempered glass.

END OF SECTION 088813

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645. Use either steel studs and tracks or embossed steel studs and tracks. Minimum Base-Metal Thickness: 0.0269 inch (0.683 mm). Depth 1-5/8", 2-1/2", 3-5/8 inches (92 mm), as indicated on drawings.
 - 1. Steel Studs and Tracks:

- a. Clark Dietrich
 - b. Phillips Mfg.
 - c. The Steel Network, Inc.
 - d. Telling Industries
2. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C 645 steel studs and tracks.
- a. Minimum Base-Metal Thickness: 0.0190 inch (20 GA.)
 - b. Depth: As indicated on Drawings, 1-5/8", 2-1/2", 3-5/8 inches.
- C. Slip-Type Head Joints: Where indicated, provide the following:
1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Same Manufacturer as metal studs.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Same Manufacturer as metal studs.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Same Manufacturer as metal studs.
 2. Minimum Base-Metal Thickness: 0.0296 inch (0.752 mm).
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Same Manufacturer as metal studs.
 2. Depth: As indicated on Drawings 1-1/2 inches (38 mm).
 3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.

- b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

END OF SECTION

SECTION 092900 – GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes gypsum board, joint treatment, accessories and sound attenuation batts.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
 - 3. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
 - 4. ASTM C1396 - Standard Specification for Gypsum Board.
 - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 6. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. Gypsum Association:
 - 1. GA 214 - Recommended Levels of Gypsum Board Finish.
 - 2. GA 216 - Application and Finishing of Gypsum Board.
 - 3. GA 600 - Fire Resistance Design Manual Sound Control.
- C. National Institute for Occupational Safety and Health:
 - 1. NIOSH Guide to the Selection and Use of Particulate Respirators.
- D. Underwriters Laboratories Inc.:
 - 1. UL - Fire Resistance Directory.

1.4 SUBMITTALS

- A. Section 013300 – Submittal Procedures: Submittal requirements.

- B. Product Data: Submit data on gypsum board, joint tape and compound; accessories; and acoustical insulation.
- C. Shop Drawings: For each Construction Subsystem indicated on Drawings, submit the following:
 - 1. One 8-1/2 by 11 sheet with list of materials required for subsystem with Product and manufacturer indicated.
 - 2. UL Assembly, or other listed assembly, clearly marking material, manufacturer and product.
 - 3. Product data for each Product clearly marking compliance and options.
- A. Manufacturer's Installation Instructions: Submit manufacturer's installation instruction for specified products.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, GA-214, GA-216 and GA-600.
- B. Fire Rated Wall Construction:
 - 1. Tested Rating: Determined in accordance with ASTM E119.
 - 2. Fire Rated Walls: Listed assembly indicated on Drawings.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Sound Attenuating Batts:
 - 1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 2. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.
 - 3. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer.
 - 4. Store materials in such a manner to permit easy access for inspection and handling.
 - a. Label insulation packages to include material name, production date and/or product code.

5. Handle materials to avoid damage. When installing or otherwise handling these insulation products, wear NIOSH-approved dust mask or respirator, gloves and long sleeved, loose fitting clothing closed at the neck and wrists. Wear safety glasses when installing.

1.9 WARRANTY

- A. Sound Attenuating Batts: Standard limited warranty against manufacturing defects.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturer:
 1. Basis of Design: Gypsum board panels and accessories manufactured by United States Gypsum Co. (USG), or approved equal.
 2. Substitutions: Section 012500 – Substitution Procedures.
- B. Description: ASTM C1396; Type X fire resistant where indicated on Drawings.
 1. Standard Gypsum Board: 5/8-inch thick, maximum available length in place; ends square cut, tapered edges; Sheetrock.
 2. Moisture Resistant Gypsum Board: 5/8-inch thick, maximum available length in place; ends square cut, tapered edges; Mold Tough Panels.

2.2 SOUND ATTENUATING BATTS

- A. Manufacturer:
 1. Basis of Design: Fiberglass Insulation System manufactured by Johns Manville, or approved equal.
 2. Substitutions: Section 012500 – Substitutions Procedures.
- B. Description: ASTM C665; preformed glass fiber, friction fit type, unfaced, formaldehyde-free.
 1. Thickness: Depth of stud unless indicated otherwise on Drawings.
 2. Surface-Burning Characteristics (ASTM E84):
 - a. Maximum Flame Spread: Less than 25.
 - b. Maximum Smoke-Developed: Less than 50.

2.3 ACCESSORIES

- A. Gypsum Board Accessories: “No coat” structural laminate drywall corner beads, or approved equal.
- B. Joint Materials: ASTM C475, reinforcing tape, joint compound, and water.

- C. Gypsum Board Screws: ASTM C1002; length to suit application.
 - 1. Screws for Metal Framing: Complying with ASTM C954 f or fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings and instructed by manufacturer.
- B. Verify substrate, adjacent materials and insulation are dry and ready to receive insulation.
- C. Examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified.

3.2 INSTALLATION

- A. Gypsum Board Installation:
 - 1. Install gypsum board in accordance with ASTM C840, GA-216 and GA-600.
 - 2. Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 3. Erect single layer fire rated gypsum board in most economical direction, with edges and ends occurring over firm bearing.
 - 4. Use screws when fastening gypsum board to metal furring or framing.
 - 5. Double Layer Applications: Use gypsum base for first layer, placed parallel to framing or furring members. Use fire rated gypsum base for fire rated partitions.
 - 6. Place second layer parallel to first layer. Offset joints of second layer from joints of first layer.
 - 7. Treat cut edges and holes in moisture resistant gypsum board with sealant.
 - 8. Place control joints consistent with lines of building spaces as indicated on Drawings.
 - 9. Place corner beads at external corners and as indicated on Drawings. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials and as indicated on Drawings.
- B. Joint Treatment:
 - 1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 2. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.
- C. Acoustic Accessories Installation:
 - 1. Insulation:
 - a. Comply with manufacturer's instructions for particular conditions of installation in each case.

- b. Blankets may be friction-fit in place until interior finish is applied. Install blankets to fill entire stud cavity. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
 - c. Install insulation in accordance with UL assemblies as applicable. d. Cut lengths to friction-fit against floor and ceiling tracks.
 - e. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes and other irregularities.
 - f. Where walls are not finished on both sides or insulation does not fill the cavity depth, supplementary support must be provided to hold product in place.
 - g. Where insulation must extend higher than 8 feet, temporary support can be provided to hold product in place until the finish material is applied.
 - h. Install without gaps or voids. Do not compress insulation.
 - i. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
2. Sealant: Install acoustic sealant at gypsum board perimeter in accordance with manufacturer's installation instructions, Section 07 9200 and ASTM C919.
- a. At walls with single layer gypsum wallboard, cut gypsum wallboard sheets 1/2 inch less than floor-to-ceiling height and position with 1/4 inch open space between gypsum board and floor, ceiling and dissimilar vertical construction. Fill 1/4 inch open space with continuous sealant beads after installation of gypsum wallboard.
 - b. At walls with double layer gypsum wallboard, after installation of gypsum board base layers, cut face layer sheets 1/2 inch less than floor-to-ceiling height and position with 1/4 inch open space between gypsum board and floor, ceiling and dissimilar vertical construction. Fill 1/4-inch open space with continuous sealant beads after installation of face layer.
 - c. Penetrations:
 - 1) Limit wall penetrations to one per stud cavity.
 - 2) At openings and cutouts, fill open spaces between gypsum board and fixtures, cabinets, ducts and other flush or penetrating items, with continuous bead of sealant.
 - 3) Seal sides and backs of electrical boxes to completely close off openings and joints.

3.3 ERECTION TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

3.4 ADJUSTING

- A. Correct damage and defects that may telegraph through finish work.
- B. Leave work smooth and uniform.

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3.5 FINISH

- A. Field Finish: See Section 099123 Interior Painting.

3.6 SCHEDULES

- A. Finishes: Provide finishes in accordance with GA-214 Level:
 - 1. Level 4: All Rooms noted in Finish Schedule on Drawings.
- B. Acoustical Insulation: Provide acoustical insulation in all new walls, and at adjacent wall cavities that do not contain sound batts, if accessible.

END OF SECTION

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 interior ceilings.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. 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 sizes indicated below:
 - 1. Acoustical Panels: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.

1.5 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. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure, including but not limited to perimeter moldings, hanger wires, clips, etc. necessary for complete installation.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:

- a. Lighting fixtures.
- b. Diffusers.
- c. Grilles.
- d. Speakers.
- e. Sprinklers.
- f. Access panels.
- g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Show all seismic details.
9. Minimum Drawing Scale: ¼ inch = 1 foot (1:48).

- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 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 Units: Full-size panels equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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.

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. In addition, all perimeter wires shall be installed on each perimeter tee, no exceptions.
- 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: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS AND SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Frost #418 on USG DXT 26 Heavy Duty Grid with MS274 Seismic Step Molding, or approved-equal. Ceiling tile and grid to match existing to remain. Contractor to verify match before purchasing material.
 - 2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern.
 - 3. Premanufactured corners shall be used at ALL wall molding equal to USG JS14.
 - 4. All ceilings shall be installed using Seismic Design Category D guidelines.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. 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 according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 4. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.
- C. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 7. Do not attach hangers to roof deck. Attach hangers to structural members.
 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 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.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 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.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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.
 - 2. Resilient molding accessories.

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, not less than 12 inches (300 mm) long.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.
- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

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 (10 deg C) or more than 90 deg F (32 deg C).

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient base and stair accessories shall comply with requirements of FloorScore certification.

2.2 THERMOPLASTIC-RUBBER BASE

- A. Rooms
 1. Basis-of-Design Product: Johnsonite Rubber Base, or approved-equal.
 2. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
 - a. Group: (solid, homogeneous).
 - b. Style and Location:
 - a. Style B, Cove.
 3. Thickness: 0.125 inch (3.2 mm).
 4. Height: 6 inches (102 mm).
 5. Lengths: Coils in manufacturer's standard length.
 6. Outside Corners: Job site formed.
 7. Inside Corners: Job site formed.
 8. Colors: For bidding purposes assume "Burnt Umber" # 63. Final color to be selected during shop drawing/submittal stage.

2.3 VINYL MOLDING ACCESSORY

- A. Basis-of-Design Product: Johnsonite Transition Strips, or approved-equal.
- B. Description: Vinyl reducer strip for resilient flooring and transition strips.
- C. Profile and Dimensions: As indicated.
- D. Locations: Provide vinyl molding accessories in areas indicated, or where resilient flooring connects to other floor finishes.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for 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.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

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; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

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 practical 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: Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting 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 horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

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 and iron.
 - 2. Gypsum board.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI 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. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI 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. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI 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. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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: 2 percent, but not less than 2 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 (7 deg C).
 - 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 (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Glidden Professional.
 - 4. PPG Paints.
 - 5. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.
 - 1. Twenty-five percent of surface area will be painted with deep tones.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions 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. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

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. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:
 - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.
- B. Galvanized-Metal Substrates:
 1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.
- C. Gypsum Board Substrates:
 1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.

- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

END OF SECTION 099123

SECTION 102600 – WALL PROTECTION

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes the following types of wall protection systems:
 - 1. Bumper Guards
- B. Related sections: The following sections contain requirements related to this section:
 - 1. Blocking in walls for fasteners; refer to section 092216 “Non-Structural Metal Framing”.

1.02 REFERENCES

- A. IBC and Life Safety
- B. American Society for Testing and Materials (ASTM)
- C. Underwriters Laboratories (UL)

1.03 SUBMITTALS

General: Submit the following in accordance with conditions of contract and Division 1 specification section 013300 “Submittal Procedures”:

- A. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.
- B. Shop drawings showing locations, extent and installation details of crash rails. Show methods of attachment to adjoining construction.
- C. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern and end cap attachment and alignment:
 - 1. 12” (304.8mm) long sample of each model specified including end cap.
- D. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.

1.04 QUALITY ASSURANCE

- A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.
- B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.
- C. Code compliance: Assemblies should conform to all applicable codes including IBC and Life Safety.
- D. Fire performance characteristics: Provide engineered PETG wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class A/1 characteristics listed below:
 - 1. Flame spread: 25 or less
 - 2. Smoke developed: 450 or less
- E. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.
- F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.

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1.05 Delivery, Storage and Handling

- A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- B. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be maintained.
- C. Material must be stored flat.

1.06 PROJECT CONDITIONS

- A. Materials must be acclimated in an environment of 65° -75°F (18°-24°C) for at least 24 hours prior to beginning the installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Interior surface protection products specified herein and included on the submittal drawings shall be manufactured by Construction Specialities, Inc., or an approved equal.

2.02 MATERIALS

- A. Engineered PETG: Extruded material, high impact Acrovyn 4000 with Shadowgrain texture, nominal .078” (1.98mm) thickness. Chemical and stain resistance per ASTM D543 standards as established by the manufacturer. Colors to be selected from one of the manufacturer’s available colors and patterns.
- B. Aluminum: Extruded aluminum should be 6063-T6 alloy, nominal .062” (1.57mm) thickness. Minimum strength and durability properties as specified in ASTM B221.
- C. Fasteners to be supplied by the manufacturer.

2.03 BUMPER GUARDS

- A. Engineered PETG Bumper Guards to be CS Acrovyn: Guard shall be securely snapped in place over the continuous aluminum retainer mounted on bumper cushions with snap-on Acrovyn 4000 cover. End caps shall be mechanically fastened with concealed fasteners. Color matched end caps and corners shall be removable for ease of replacement. Attachment hardware shall be appropriate for wall conditions.
 - 1. Model BG -30N 2 ¾” (69.7mm) high bumper guard, or an approved equal.

2.04 FABRICATION

- A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify condition detrimental to proper or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install the work of this section in strict accordance with the manufacturer's recommendations, using only approved mounting hardware and locating all components firmly into position, level and plumb.
- B. Temperature at the time of installation must be between 65°-75°F (18°-24°C) and be maintained for at least 48 hours after the installation.
- C. Adjust installed end caps as necessary to ensure tight seams.
- D. Where splices occur in horizontal runs, splice retainer and rail at different locations along the run.

3.04 CLEANING

- A. General: Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.
- B. Remove surplus materials, rubbish, and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher and depth of wall (Contractor to verify).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Specialties, Inc.
 - b. Fire-End & Croker Corporation.
 - c. GMR International Equipment Corporation.
 - d. Guardian Fire Equipment, Inc.
 - e. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - f. Kidde Residential and Commercial Division.
 - g. Larsens Manufacturing Company.
 - h. Modern Metal Products, Division of Technico Inc.
 - i. MOON American.
 - j. Nystrom, Inc.
 - k. Potter Roemer LLC.
 - l. Strike First Corporation of America.
- B. Cabinet Construction: Nonrated and 1-hour fire rated. See plans for locations.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

- E. Cabinet Trim Material: Steel sheet.
- F. Door Material: Steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
 - 2. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 2. Provide inside latch and lock for break-glass panels.
 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. 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 FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International.
 - c. Badger Fire Protection.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. Guardian Fire Equipment, Inc.
 - g. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - h. Kidde Residential and Commercial Division.
 - i. Larsens Manufacturing Company.
 - j. MOON American.
 - k. Nystrom, Inc.
 - l. Pem All Fire Extinguisher Corp.; Pem Systems, Inc.
 - m. Potter Roemer LLC.
 - n. Pyro-Chem; Tyco Fire Suppression & Building Products.
 - o. Strike First Corporation of America.
 - 2. Valves: Manufacturer's standard.

3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container (104416.C) UL-rated 3-A:40-B:C, 6-lb (2.7-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 123661 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.
- D. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches (150 mm) square.
 - 2. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avonite Surfaces.
 - b. E. I. du Pont de Nemours and Company.
 - c. Formica Corporation.
 - d. LG Chemical, Ltd.
 - 2. Type: Provide Standard type unless Special Purpose type is indicated.
 - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom.
- B. Configuration:
 - 1. Front: Straight, slightly eased at top.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. End Splash: Matching backsplash.

- C. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material with wood-trimmed edges.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- F. Joints: Fabricate countertops without joints.
- G. Cutouts and Holes:
 - 1. Cable Grommets: Make cutouts for grommets using template or pattern furnished by grommet manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop,

form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Pre-drill holes for screws as recommended by manufacturer.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661

SECTION 210500 – COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-suppression system submittal requirements.
2. Sleeves.
3. Escutcheons.
4. Hangers and supports.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for vibration isolation devices and seismic restraints.
2. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

1.3 DEFINITIONS

- A. "Contractor" means an individual or entity licensed to engage in the planning, sale, installation, repair, alteration, addition, maintenance, or inspection of fire suppression systems.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For fire-suppression sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

- C. Delegated-Design Submittal: For fire-suppression sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data. Submittal shall be completed by:

1. A professional engineer licensed in the State bearing his professional seal and signature

2. A fire sprinkler contractor licensed in the State with a qualifying party holding a NICET Level IV Technician Certification in "Fire Protection Engineering Technology Automatic Sprinkler System Layout."

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For licensed fire sprinkler contractor or professional engineer.
- B. Fire-Suppression System Drawings: Working plans, prepared according to NFPA 13, must be prepared for every fire sprinkler system.
 1. Hydraulic Calculations: Fire suppression system shop drawings and hydraulic calculations must contain sufficient information to show compliance with the drawings and National Fire Protection Association standards required in the Fire Sprinkler System Specification Sheet (FSSSS).
 2. Fire sprinkler shop drawings must be prepared by a licensed fire suppression contractor for every fire suppression system and in accordance with South Carolina Code of Laws - Fire Protection Sprinkler Systems Act (Title 40, Chapter 10).
 - a. Shop drawings must bear the authorized signature and license number of the fire sprinkler contractor licensed in this State who prepared the drawings.
 3. The shop drawings shall accurately reflect actual conditions affecting the required layout of the fire sprinkler system.
 - a. Shop drawings shall show light fixtures, large ducts, mechanical equipment, structural elements, architectural elements and all other items which may affect the layout of sprinkler heads and piping. Plans showing sprinkler work shall be not less than 1/8 inch per foot.
 - b. Shop drawings shall show locations of pipe supports, seismic braces and end-of-line pipe restraints in plan view. Shop drawings shall also detail pipe supports, seismic braces and end-of-line restraints.
 - c. The shop drawings shall indicate all areas to be sprinkled and type of hazard, locations and sizes of water supply pipe, major drains and tests, alarm check valve and water motor gong, risers and other main piping and valves, and the location of fire department connections. Complete riser diagrams shall also be submitted. The drawings shall locate by dimension all fire protection piping and sprinkler heads.
 - d. Shop drawings shall be provided in sufficient detail to show compliance with the Standards referenced on the Fire Sprinkler System Specification Sheet (FSSSS) to the degree required by the regulations of the State Fire Marshal.
 4. The fire sprinkler contractor shall certify the accuracy of his shop drawings prior to submitting them for review and approval.
 5. The fire sprinkler shop drawings shall be reviewed and approved by the Architect's Engineer of Record who prepared the Fire Sprinkler System Specification Sheet.
 6. After determination of compliance with the Fire Sprinkler System Specification Sheet, the Engineer of Record will issue a Certificate of Compliance.

7. The fire sprinkler contractor shall submit the shop drawings, Fire Sprinkler System Specification Sheet and Certificate of Compliance to the State Fire Marshal's Office or to his designee for further review and approval.
8. Upon approval by the State Fire Marshal's Office, the Architect's Engineer of Record will submit a copy of the State Fire Marshal's approval letter to the Contractor, Architect, and Authority Having Jurisdiction (AHJ).
9. Unless authorized in writing by AHJ, neither the Contractor nor subcontractor at any tier shall submit the fire sprinkler shop drawings directly to the State Fire Marshal's Office or other authorities having jurisdiction for approval.

- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-suppression systems and specialties to include in emergency, operation, and maintenance manuals.
- B. At Final Completion, six (6) copies of the approved manual with as-built drawings and a copy of NFPA-25 shall be delivered to the Owner.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing licensed 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 or licensed contractor.
 - b. The installer shall hold all licenses and obtain all permits necessary to perform work of this type.
 - c. The installer shall be regularly engaged in the fabrication, installation, testing, and servicing of automatic sprinkler systems.
- 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:
 1. Fire-suppression piping, equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.

1.8 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to NFPA and ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design seismic-restraint hangers and supports for piping and obtain approval from authorities having jurisdiction.
- B. NFPA Compliance: Comply with NFPA 13.

1.9 FIELD CONDITIONS

- A. Interruption of Existing Fire-Suppression Service: Do not interrupt fire-suppression service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression service according to requirements indicated:
 - 1. Notify Owner no fewer than ten (10) days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of fire-suppression service without Owner's written permission.

1.10 WARRANTY PERIOD

- A. The Contractor shall provide a one (1) year warranty for all materials and workmanship beginning with the date of Substantial Completion. The Contractor shall be responsible during the design, installation, testing, and warranty periods for any damage caused by him or his subcontractors or by defects in his or his subcontractors' work, materials, or equipment.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Sleeves
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc
 - b. CALPICO, Inc
 - c. GPT; an EnPro Industries company
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

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3. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
4. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Grout

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000-psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

2.2 ESCUTCHEONS

A. Manufacturers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Co.; a Masco company
 - b. Dearborn Brass
 - c. Keeney Manufacturing Company (The)
 - d. Mid-America Fittings, Inc.
 - e. ProFlo; a Ferguson Enterprises, Inc. brand

B. Escutcheons

1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel or brass with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

C. Floor Plates

1. Split Floor Plates: Steel with concealed hinge.

2.3 HANGERS AND SUPPORTS

- A. It shall be the responsibility of the Contractor to provide an adequate pipe hanger and support system for all pipe systems in accordance with recognized engineering practices, using standard, commercially accepted pipe hangers and suspension equipment. Comply with UL 203.

B. Metal Pipe Hangers and Supports

1. Carbon-Steel Pipe Hangers and Supports:

- a. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
- b. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
- c. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

C. Fastener Systems

1. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC
 - 4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line, an Eaton business
 - 2) Hilti, Inc.
 - 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 4) MKT Fastening, LLC
- b. Indoor Applications: Zinc-coated or stainless steel.
- c. Outdoor Applications: Stainless steel.

3. Per IBC Section 1912 and ACI 318 Appendix D, all concrete anchors within the scope of ACI 318 require approved anchors for crack concrete. Attachment devices shall have certified load test data from an independent test laboratory and shall be capable of carrying a minimum of five times the design load. The concrete anchors for the following supported items need to meet the crack concrete requirements:

- a. Any suspended pipe, larger than 2", regardless of material.
- b. All components with an I_p 1.5.
- c. All components required to function after a seismic event.
- d. Anywhere required by ASCE 7.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Fasten sleeves securely in floors and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials from being forced into space between pipe and sleeve during construction
- C. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- D. Install sleeves in concrete floors, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- E. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide minimum 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- F. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.3 ESCUTCHEON INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping and Relocated Existing Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
 - 2. Escutcheons for Existing Piping to Remain:
 - a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.
 - b. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install hangers and supports to allow controlled seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Install lateral bracing with pipe hangers and supports to prevent swaying.
- F. Install building attachments within concrete slabs. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction

of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

- G. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to maximum 1-inch.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.7 SLEEVE SCHEDULE

- A. Use sleeves for the following piping-penetration applications:
 - 1. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

3.8 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements 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 finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

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- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. 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 stationary pipes NPS 1/2 to NPS 30.
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
 - 3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of stationary pipes NPS 1/2 to NPS 8.
 - 4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of stationary pipes NPS 3/8 to NPS 8.
 - 5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of stationary pipes NPS 3/8 to NPS 3.
 - 6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- 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 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- I. Hanger-Rod Attachments: Comply with NFPA requirements.
- J. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. C-Clamps (MSS Type 23): For structural shapes.
 - 3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- K. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210500

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION 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. Snubbers.
2. Restraint channel bracings.
3. Seismic-restraint accessories.

B. Related Requirements:

1. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

- A. ASCE/SEI: American Society of Civil Engineers/Structural Engineering Institute.
- B. IBC: International Building Code.
- C. ICC-ES: ICC-Evaluation Service.
- D. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

- a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
 3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: See Architectural front sheets.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: See architectural front sheets.
 - a. Component Importance Factor: 1.5.
 - 3. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 GENERAL

- A. Select vibration isolating units for the lowest operating speed of equipment, so designed that natural frequency of equipment and base mass is not less than 1.5 times the lowest operating frequency of the moving equipment, but not a multiple or harmonic of the base frequency. Furnish vibration isolation producing a uniform loading and deflection even when equipment weight is not evenly distributed, vibration isolation shall be stable during starting and stopping of equipment without excessive traverse and eccentric movement of equipment.

- B. The installed vibration isolation system for each floor or ceiling mounted item of equipment shall have a maximum lateral motion under equipment start up and shut down conditions of 1/4 inch. Motions in excess shall be restrained by approved spring type mounting.
- C. The type of isolation, base, and minimum static deflection shall be as required for each specific equipment application, but not less than that specified herein when supported on a solid concrete structural slab having a thickness of not less than four (4) inches. Should vibration isolators installed for the equipment prove inadequate to prevent transmission of equipment vibrations to the building structure or limit equipment vibration originated noise in the building spaces to acceptable levels, the isolators shall be replaced with units having the largest deflection that can be practicably installed.

2.3 SNUBBERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control, Inc
 - 2. Mason Industries, Inc.
 - 3. Novia; A Division of C&P
 - 4. Vibration Mountings & Controls, Inc
- B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.4 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
 - 4. Unistrut; Part of Atkore International
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.5 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Novia; A Division of C&P
 - 5. TOLCO
 - 6. Vibration & Seismic Technologies, LLC
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

- B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Piping Restraints:
 - 1. Comply with requirements in NFPA and MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in 211313 "Wet-Pipe Sprinkler Systems," for piping flexible connections.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

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3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 210548

SECTION 211313 - WET-PIPE SPRINKLER 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. Sprinklers.

B. Related Requirements:

- 1. Section 210500 "Common Work Results for Fire Protection" for additional submittal requirements.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

- A. Refer to Section 210500 "Common Work Results for Fire Protection" for additional submittal requirements.

B. Product Data: For each type of product.

- 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings: For wet-pipe sprinkler systems.

- 1. Include plans, elevations, sections, and attachment details.
- 2. Include diagrams for power, signal, and control wiring.

- D. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer or licensed fire sprinkler contractor responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Refer to Section 210500 "Common Work Results for Fire Protection" for additional submittal requirements.
- B. Qualification Data: For licensed fire sprinkler contractor or professional engineer.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and 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. 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 or licensed fire sprinkler contractor.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Design sprinkler system, including comprehensive engineering analysis by a qualified professional engineer or licensed fire sprinkler contractor, using performance requirements and design criteria indicated.

1. Refer to drawings and Fire Sprinkler System Specification Sheet.
- D. Pipe sizes shall be as required by NFPA Standards but in no case less than those shown on the drawings or specified.
- E. Sprinkler system design shall be approved by authorities having jurisdiction.
- F. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
- G. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 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.

2.3 BLACK STEEL PIPE AND ASSOCIATED FITTINGS

- A. Schedule 40: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.
- B. Schedule 10: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Uncoated, Steel Couplings: ASTM A 865/A 865M, threaded.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME B16.1, Class 125.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- H. Grooved-Joint, Steel-Pipe Appurtenances:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International
 - b. Corcoran Piping System Co.
 - c. National Fittings, Inc
 - d. Shurjoint Piping Products USA Inc
 - e. Smith-Cooper International
 - f. Tyco Fire Products LP
 - g. Victaulic Company
 2. Pressure Rating: 175 psig minimum.

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3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. 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.

2.4 SPRINKLER PIPING SPECIALTIES

- A. General Requirements for Wet-Pipe System Fittings: UL listed for wet-pipe service.
- B. Branch Outlet Fittings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of 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 minimum.
 4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 5. Type: Mechanical-tee 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.
- C. Flexible Sprinkler Hose Fittings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fivalco Inc.
 - b. FlexHead Industries, Inc.
 - c. Gateway Tubing, Inc.
 - d. Victaulic Company
 2. Standard: UL 1474.
 3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 4. Pressure Rating: 175-psig minimum.
 5. Size: Same as connected piping, for sprinkler.

2.5 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Globe Fire Sprinkler Corporation
 - 2. Reliable Automatic Sprinkler Co., Inc. (The)
 - 3. Tyco Fire Products LP
 - 4. Victaulic Company
 - 5. Viking Corporation
- B. General Requirements:
 - 1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - 2. Pressure Rating for Automatic Sprinklers: 175-psig 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 orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
 - 1. Chrome plated
 - 2. Bronze
 - 3. Painted.
- E. Cover Finish:
 - 1. White, to match ceiling.
- F. 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: Chrome-plated steel, one piece, flat.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
 - C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
 - 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 and smaller.
 - F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
 - G. Install sprinkler piping with drains for complete system drainage.
 - H. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
 - I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
 - J. Fill sprinkler system piping with water.
 - K. Install sleeves for piping penetrations of walls, ceilings, and floors.
 - L. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 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 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 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, 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.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-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 grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.4 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.

3.5 FIELD QUALITY CONTROL

- A. Perform the following 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. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.8 PIPING SCHEDULE

- A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be the following:
 1. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.9 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications, unless otherwise indicated:
 1. Rooms with Suspended Ceilings: Concealed sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 1. Concealed Sprinklers: Rough brass, with factory-painted cover plate to match the color of the ceiling.
- C. The correct temperature rating of every sprinkler head shall be used according to the maximum ceiling temperature rating and requirements in NFPA 13. All sprinklers with the exception of specified decorative types and bulb type sprinklers shall have their frame arms colored at the factory in accordance with the standard table in NFPA 13. High temperature heads shall be used where required by NFPA 13 and the AHJ.

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3.10 FIELD PAINTING

- A. Painting of sprinkler systems above suspended ceilings is not required.

END OF SECTION 211313

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

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 describes the common work requirements for the mechanical work included in Division 22 and applies to all sections of Division 22.

1.3 DEFINITIONS

- A. Following are definitions of terms and expressions used in the Mechanical and Electrical Sections:
 - 1. Provide: Furnish and install
 - 2. Directed: Directed by the Architect or Engineer
 - 3. Indicated: Indicated in Contract Documents
 - 4. Concealed: Hidden from normal sight; includes items within furred spaces, pipe and duct shafts, above suspended ceilings and within return air plenums.
 - 5. Exposed: Non concealed - Work within Equipment Rooms shall be considered exposed.
 - 6. Exterior: Items being or situated outside. Items located within a crawl space shall be considered exterior.
 - 7. Conditioned: Heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means, so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.
 - 8. Piping: Includes pipes, fittings, valves, hangers, and accessories comprising a system.

1.4 CODES, REGULATIONS, AND PERMITS:

- A. References to codes, standards, specifications, and regulations apply to the latest edition adopted by the jurisdiction where the project is located.
- B. All materials furnished and all work installed shall comply with the applicable rules, regulations, and recommendations of the following bodies:
 - 1. International Building Code
 - 2. International Existing Building Code
 - 3. International Mechanical Code
 - 4. International Plumbing Code
 - 5. International Fire Code
 - 6. International Energy Code
 - 7. National Electric Code

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8. National Fire Protection Association Standards
9. State Fire Marshal Regulations
10. Local Fire Marshal Regulations
11. ASHRAE Standards and Handbooks (Latest Editions)
12. Local Health Department
13. State Health Department
14. Local Utility Companies
15. Underwriters Laboratories
16. Owner's Insurance Underwriter Standards
17. Environmental Protection Agency

- C. Give all necessary notices, obtain all permits, and pay all fees and other costs, including those for utility connections or extensions in connection with the work. File all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction. Obtain all required certificates of inspection and deliver same to the Architect before request for acceptance and final payment for the work.

1.5 SITE VISIT

- A. Prior to preparing the bid, it is recommended that the Contractor and subcontractors shall visit the site and familiarize themselves with all existing conditions, make all necessary investigations as to locations of utilities, and all other matters which can affect the work.
- B. No additional compensation will be made to the Contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.6 DRAWINGS

- A. The Contract Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Any offsets, rises, or transitions not shown on the drawings and required to provide a complete system shall be provided at no additional contract cost. Do not scale the drawings. Consult the Architectural and Structural drawings and details for exact location of structure and equipment; where same are not definitely located, obtain this information from the Architect.
- B. In the event of ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of work, or 2) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation.

1.7 SINGULAR NUMBER

- A. Where any device or part of equipment is herein referred to in the singular number (such as "valve"), such reference applies to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to Section 013300 "Submittal Procedures" for additional information.
- B. All component parts of each items of equipment or device shall bear the manufacturers' name plate; giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate the maintenance or replacement. The name plate of a subcontractor or distributor will not be acceptable. Where Underwriters' Laboratories standards apply, material and equipment shall be approved by them and shall bear the UL Label.
- C. In specifying materials, three (3) general procedures are used. The three (3) classifications are as follows:
 - 1. GROUP 1: When a material or equipment is specified by brand name or other identifying information and three (3) or more brands are named it is considered that any one (1) of the brands so named will perform as desired, and the Contractor shall base his proposal on one (1) of the named brands. The first brand named or identified basis of design shall be used as a standard. The other brands named shall be equal to the specified brand in all respects. If one (1) of the other brands named is used it shall be the Contractor's responsibility to verify proper clearances and fit of the substituted equipment.
 - 2. GROUP 2: When the material or equipment is specified with the phrase "...or approved equal..." after a brand name and other identifying information, it is intended that the brand name is used for the purpose of establishing a minimum acceptable standard of quality and performance and Contractor may base his bid proposal on any item which is in all respects equal to that specified and presents essentially the same appearance. It shall be the Contractor's responsibility to ensure proper fit and clearances of all substituted equipment.
 - 3. GROUP 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, American Society of Testing and Materials, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects to the referred "Standard Specification".
- D. It is distinctly understood: (1) that the Architect will use his own judgment in determining whether or not any materials, equipment or methods offered in substitution are equal to those specified; (2) that the decision of the Architect on all such questions of equality is final; and (3) that all substitutions will be made at no increase in cost to the Owner.
- E. Upon receipt of written approval from Architect, Contractor may proceed with substitution providing Contractor assumes full responsibility for, and makes, at his own expense, any changes or adjustments in construction or connection with other work that may be required by the substitution of such materials, equipment or methods. In the event of any adverse decisions by the Architect no claim of any sort shall be made or allowed against the Owner.
- F. All pipe and fittings shall be from a domestic manufacturer.

2.2 FIRE-RATED PENETRATIONS

- A. Provide UL Listed fire penetration systems in openings in rated floors, walls, and other elements of construction. Provide UL listed fire penetration systems at all new and existing pipe penetrations of new and existing rated construction within the area of work. Coordinate work of this section with all other trades necessary for the proper installation of the fire rated penetration systems.
- B. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications. Submit copies of manufacturer's specifications, recommendations, inspection requirements, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
- C. All fire penetration systems shall reference ASTM E814/UL 1479 - Fire Test of Through - Penetration Fire Stops.
- D. All systems shall be UL tested and listed in the UL Fire Resistance Directory.
- E. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one (1) year from date of substantial completion.
- F. 3M products have been specified as the penetration fire stop basis of design. Other manufacturer's systems are acceptable providing they meet the requirements set forth in this specification. The fire rated penetration systems shall be the products of one manufacturer to the maximum extent possible. The products of more than one manufacturer shall not be used as a combined seal.
- G. Provide materials classified by UL to provide fire stopping equal to time rating, both "F" and "T" ratings, of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814. Systems shall be smoke and air tight.
- H. Deliver material undamaged in manufacturer's clearly labeled, unopened containers identified with brand, type, grade, and UL label where applicable. Coordinate delivery with scheduled installation date to allow minimum storage time at site. Store material in clean, dry ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instruction.
- I. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- J. Furnish adequate ventilation if using solvent. Furnish forced air ventilation during installation if required by manufacturer. Keep flammable materials away from sparks or flame. Provide

masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping resistance.

- K. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose, materials, rust, or other substances that may affect proper fitting, adhesion of the required fire resistance.
- L. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instructions. Seal holes or voids made by penetrations to ensure an effective smoke barrier. Where floor openings without penetrating items are more than four (4) inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor. Protect materials from damages on surfaces subject to traffic.
- M. Clean up spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- N. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by local inspectors and other trades.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. The quality of workmanship required, for each trade, in the execution of work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Architect and his decision as to acceptable quality is final.
- B. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.2 CUTTING AND PATCHING

- A. Cutting and patching associated with the work shall be performed in a neat and workmanlike manner. Existing surfaces, which are damaged by the Contractor, shall be repaired or provided with new materials. All patching shall be done with materials and methods similar to existing adjacent work, subject to approval of the Architect. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by reciprocating or rotary, non-percussive methods.
- B. Patching of areas disturbed by installation of new work shall match existing adjacent surfaces in material, texture, and color.

3.3 PROTECTION OF EXISTING WORK

- A. When working in and around the building, extreme care shall be exercised with regard to protection of the structure and plumbing services. Repair or replace, to the satisfaction of the Architect, any existing work damaged in the performance of the new work.

3.4 SURVEYS AND MEASUREMENTS

- A. Base all measurements (both horizontal and vertical) from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check correctness of same as related to the work. Verify locations of existing utilities and inverts of same prior to the start of any systems shown connecting to existing utilities.
- B. Should the Contractor discover any discrepancy between actual measurements or conditions, and those indicated, which prevent following good practice or the intent of the drawings and specifications, he shall notify the Architect and shall not proceed with his work until he has received instruction from the Architect.

3.5 HANDLING AND STORAGE OF MATERIAL

- A. Proper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment and materials so that no equipment or materials are damaged.
- B. All equipment delivered to the job site shall be stored on pedestals, above the ground and under roof or other approved covering. All enclosures for equipment shall be weatherproof. All motors, drives, switchgear, panels, etc. which are not totally enclosed, that are involved in the work, shall be stored in a heated, dry, water protected area with a minimum temperature of fifty degrees (50) Fahrenheit. All valves shall be stored under roof on wood pedestals, above ground. All insulation shall be stored under roof or in trailers, adequately protected from the weather. The Contractor shall follow all written instructions and recommendations of the manufacturer and all requirements of the Architect in oiling, protection and maintenance of equipment during storage. It shall be the Contractor's complete responsibility for the storage and care of the equipment and materials.
- C. If any equipment and/or materials are found to be in poor condition at the time of installation the Architect may, at his discretion, order the Contractor to furnish and install new equipment and/or material at no cost to the Owner.

3.6 COOPERATION WITH OTHER TRADES

- A. Mechanical trades shall give full cooperation to other trades and shall furnish in writing, with copies to Architect any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay. Exact location of all mechanical and equipment, devices, etc. in finished spaces shall be coordinated with Architectural reflected ceiling plans, elevations and details.

3.7 CLEANING AND PATCHING

- A. Thoroughly clean all exposed surfaces of equipment and material and leave in a neat, clean condition.
- B. Restore and touch-up factory finishes which have been damaged during construction.

3.8 ACCESSIBILITY

- A. Equipment shall be installed per manufacturer's recommended clearance guidelines with sufficient space for maintenance personnel service, operate, and maintain equipment.
- B. Locate all above ceiling equipment which must be serviced, operated, or maintained, in fully accessible positions to eliminate the need for access panels and doors. Equipment shall include, but not be limited to, valves, clean-outs, motors, controllers, dampers, drain points, etc.
- C. Where overhead equipment cannot be located above spaces with either no ceilings or removable acoustical ceiling tiles, contractor shall provide, as part of the contract and no expense to the Owner, fourteen (14) gauge painted steel access doors where required and/or where directed (color shall match ceiling).
 - 1. Access doorss shall be Milcor or approved equal to suit material in which installed.
 - 2. Access doors installed in fire rated walls or shafts shall be labeled and shall match rating of the construction.
 - 3. Doors shall be of sufficient size to allow access to all components; minimum size shall be eighteen (18) inches by eighteen (18) inches.
 - 4. Doors in Toilet Rooms and Janitor's Closets shall be Type 304 stainless steel.
 - 5. All doors shall have cylinder locks operable from same key.
 - 6. Submit shop drawings for approval. Locations shall be coordinated with the Architect and indicated on the composite installation and coordination drawings
- D. Equipment deemed inaccessible by the Architect shall be reworked by the Contractor at no expense to the Owner.

3.9 DEMOLITION

- A. All existing piping, conduit, equipment and materials not required for re-use or re-installation shall be removed. Any existing materials and equipment which are removed and are desired by the Owner, or are indicated to remain the property of the Owner, shall be delivered to him on the premises by the Contractor where directed by the Architect. All other materials and equipment which are removed shall become the property of the Contractor and shall be removed by him from the premises.
- B. Existing piping that remains concealed, buried, or otherwise contained in the remaining slabs and walls shall be capped, plugged, or otherwise sealed. All pipes shall be cut so that their capped or plugged ends will be below the finished floors or behind finished surfaces.

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- C. Existing wiring, where possible, shall be removed or pulled through conduits. Wiring remaining shall be cut back behind the termination of conduits so that conduits can be adequately capped, plugged, or sealed.

3.10 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. When existing plumbing work is removed, all pipes, valves and materials shall be removed to a point below the finished floors or behind finished walls and capped. Such points shall be far enough behind finished surfaces to allow for the installation of the normal thickness of finished material.
- B. When the work specified hereinafter connects to existing equipment or piping, the Contractor shall perform all necessary alterations, cuttings, or fitting of existing work as may be necessary or required to make satisfactory connections between the new and existing work and to leave the completed work in a finished and workmanlike condition, to the entire satisfaction of the Architect.
- C. When the work specified hereinafter or under other divisions of the contract necessitates relocation of existing equipment, piping, or ductwork, the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike condition, to the satisfaction of the Architect. All work resulting in an extra to the contract shall be approved by the Owner and Architect before proceeding.
- D. All cutting and patching necessary for the installation of the plumbing work shall be done under this Division. Any damage done to the work already in place shall be repaired at the Contractor's expense. Patching shall be uniform in appearance and shall match the surrounding surface.
- E. When the work specified hereinafter connects to existing piping, to avoid possible cross-connection of supply and return lines, the Contractor shall field verify the configuration of supply and return lines, using an appropriate temperature sensing or pressure device, before making final connections. Any discrepancy between construction documents and field verification should be promptly reported to the Architect before completing piping installation, so proper piping configuration can be verified.

3.11 INTERRUPTION OF EXISTING UTILITIES

- A. Notify the Owner in writing at least ten (10) calendar days in advance of any required shutdown of water, sewage, gas, electrical service or other utility. Upon written receipt of approval from Owner, shutdowns shall be performed between the hours of six (6) p.m. and six (6) a.m. including clean-up or as directed otherwise and shall be accomplished at no additional cost.
- B. At the end of each interruption, all services shall be restored so that normal use of the building can continue.

END OF SECTION 220500

SECTION 220517 - SLEEVES AND SLEEVE SEALS 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. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc
 - 2. CALPICO, Inc
 - 3. GPT; an EnPro Industries company

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- B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc
 - 2. CALPICO, Inc
 - 3. GPT; an EnPro Industries company
 - 4. Metraflex Company (The)
 - 5. Proco Products, Inc
- B. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 2. Designed to form a hydrostatic seal of 20 psig minimum.
 - 3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 4. Pressure Plates: Carbon steel.
 - 5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc
 - 2. CALPICO, Inc
 - 3. GPT; an EnPro Industries company
 - 4. Metraflex Company (The)
 - 5. Proco Products, Inc
- B. Description:
 - 1. Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
 - 2. Plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Fasten sleeves securely in floors and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials from being forced into space between pipe and sleeve during construction
- C. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- D. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- E. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide minimum 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- F. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with

requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout to seal the space around outside of sleeve-seal fittings.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

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2. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves or sleeve-seal fittings.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves.

3. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

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. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fastener systems.
 - 4. Related Requirements:
 - 5. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. It shall be the responsibility of the Contractor to provide an adequate pipe hanger and support system for all pipe systems in accordance with recognized engineering practices, using standard, commercially accepted pipe hangers and suspension equipment.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. TRAPEZE PIPE HANGERS

- C. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

D. FASTENER SYSTEMS

- E. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. MKT Fastening, LLC
 - d. Simpson Strong-Tie Co., Inc.

- F. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - d. MKT Fastening, LLC
2. Indoor Applications: Zinc-coated or stainless steel.

3. Outdoor Applications: Stainless steel.
- G. Per IBC Section 1912 and ACI 318 Appendix D, all concrete anchors within the scope of ACI 318 require approved anchors for crack concrete. Attachment devices shall have certified load test data from an independent test laboratory and shall be capable of carrying a minimum of five times the design load. The concrete anchors for the following supported items need to meet the crack concrete requirements:
1. Any suspended pipe, larger than 2", regardless of material.
 2. All components with an I_p 1.5.
 3. All components required to function after a seismic event.
 4. Anywhere required by ASCE 7.
- H. MATERIALS
- I. Aluminum: ASTM B 221.
- J. Carbon Steel: ASTM A 1011/A 1011M.
- K. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- L. Stainless Steel: ASTM A 240/A 240M.
- M. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported operating components with a design safety factor of not less than five.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- H. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- J. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 2-1/2 and Larger: Include thermal hanger shield inserts of length at least as long as protective shield. Insert thickness shall be the same thickness as piping insulation. Fill interior voids with insulation that matches adjoining insulation and seal as appropriate.
- K. In no case shall wire or perforated strap be used for pipe or conduit support.
- L. METAL FABRICATIONS
- M. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- N. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- O. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 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 maximum 1-inch.
- C. HANGER AND SUPPORT SCHEDULE
- D. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- E. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- F. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

- G. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- H. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- I. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- J. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- K. Use padded hangers for piping that is subject to scratching.
- L. Use thermal hanger-shield inserts for insulated piping and tubing.
- M. 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.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- N. 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 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- O. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- P. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- Q. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- R. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

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- S. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- T. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- U. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS 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.
- B. The International Building Code and ASCE/SEI 7 Standard apply to all work associated with the seismic installation of all new plumbing piping and equipment. Refer to Structural drawings and ASCE/SEI 7 for seismic and wind loads and additional information.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe-riser resilient supports.
 - 2. Resilient pipe guides.
 - 3. Snubbers.
 - 4. Restraint channel bracings.
 - 5. Restraint cables.
 - 6. Seismic-restraint accessories.
 - 7. Related Requirements:
 - 8. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
 - 9. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

- A. ASCE/SEI: American Society of Civil Engineers/Structural Engineering Institute.
- B. IBC: International Building Code.
- C. ICC-ES: ICC-Evaluation Service.
- D. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.
- C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the manufacturer's qualified professional engineer responsible for their preparation.
 - a. Provide approved submittals of all equipment and systems required to have seismic and wind restraint to the seismic restraint provider for use in making calculations and selecting the appropriate seismic restraint devices and systems.
 2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
 3. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For situations where limited space necessitates maximum utilization for efficient installation of different components, show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: See architectural front sheets.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: See architectural front sheets.
 - a. Component Importance Factor: 1.5
 - b. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.

- c. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

B. PIPE-RISER RESILIENT SUPPORT

- C. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene.
1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.2 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.
1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

B. SNUBBERS

- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kinetics Noise Control, Inc
 2. Mason Industries, Inc.
 3. Novia; A Division of C&P
 4. Vibration Mountings & Controls, Inc

- D. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.3 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business
 2. Hilti, Inc.
 3. Mason Industries, Inc.

4. Unistrut; Part of Atkore International

- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.4 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Gripple Inc.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
 4. Novia; A Division of C&P
 5. Vibration & Seismic Technologies, LLC
 6. Vibration Mountings & Controls, Inc
- B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.5 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
 4. Novia; A Division of C&P
 5. TOLCO
 6. Vibration & Seismic Technologies, LLC
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- E. EXECUTION

2.6 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.7 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

2.8 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

G. ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- H. Install flexible connections in piping where they cross expansion and seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

2.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

- C. Remove and replace malfunctioning units and retest as specified above.

- D. Prepare test and inspection reports.

E. Manufacturer's Inspection:

1. A representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation errors, improperly selected isolation or restraint devices, or other faults that could affect the performance of the system.
2. Contractor shall submit manufacturer's representative's final report indicating all isolation as being properly installed or requiring correction. If corrections are required, include steps to be taken to properly complete the isolation work.

END OF SECTION 220548

SECTION 221316 - SANITARY WASTE AND VENT PIPING AND 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. Section Includes:

1. Hubless, cast-iron soil pipe and fittings.
2. Specialty pipe fittings.
3. Cleanouts.
4. Air-admittance valves.
5. Miscellaneous sanitary drainage piping specialties.
6. Contractor shall perform all work within the building and to a point five (5) feet from the building wall, unless otherwise noted.
7. Contractor shall coordinate with site sanitary drainage services provided under another Division.
8. The contractor shall make the final connection of the building sanitary drainage to the site sanitary drainage.

- B. Contractor shall arrange for and coordinate sanitary drainage services. Contractor shall perform all work within the building and to a point five (5) feet from the building wall and shall be coordinated with civil work. The building sanitary drainage shall connect to site sanitary drainage provided under another Division.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping, drains and specialty materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than ten days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
 - 2. Waste, Force-Main Piping: 50 psig.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. All pipe and fittings shall be from a domestic manufacturer.
- C. HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AB & I Foundry
 - 2. Charlotte Pipe and Foundry Company
 - 3. Tyler Pipe
- E. Pipe and Fittings:

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1. Marked with CISPI collective trademark and NSF certification mark.
2. Standard: ASTM A 888 or CISPI 301.

F. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky
 - b. Charlotte Pipe and Foundry Company
 - c. MIFAB, Inc
 - d. Tyler Pipe
2. Standard: ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

G. SPECIALTY PIPE FITTINGS

H. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings (Underground):
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Fernco Inc
 - 2) Mission Rubber Company, LLC; a division of MCP Industries
 - 3) Plastic Oddities
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings (Aboveground):
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Fernco Inc

- 2) Mission Rubber Company, LLC; a division of MCP Industries
- 3) Plastic Oddities

- b. Standard: ASTM C 1460.
- c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- d. End Connections: Same size as and compatible with pipes to be joined.

I. Dielectric Fittings

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) WATTS
 - 2) Wilkins
 - 3) Zurn Industries, LLC
 - b. Standard: ASSE 1079.
 - c. Pressure Rating: 150 psig minimum at 180 deg F.
 - d. End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) WATTS
 - 2) Wilkins
 - 3) Zurn Industries, LLC
 - b. Standard: ASSE 1079.
 - c. Factory-fabricated, bolted, companion-flange assembly.
 - d. Pressure Rating: 150 psig minimum at 180 deg F.
 - e. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

J. CLEANOUTS

- K. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Jay R. Smith Mfg. Co.
 2. Josam Company; Josam Div.
 3. MIFAB, Inc.
 4. Tyler Pipe.

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5. Wade.
6. WATTS.
7. Zurn Industries, LLC.

L. Exposed and Above-Ceiling Cleanouts:

1. Basis-of-Design Product: Provide Josam Series 58900 or comparable product.
2. Size: Same as connected branch.
3. Body Material: No-hub, cast-iron soil pipe test tee] as required to match connected piping.
4. Closure: Bronze, countersunk plug.
5. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

M. Wall Cleanouts:

1. Basis-of-Design Product: Provide Josam Series 58910-Z or comparable product.
2. Size: Same as connected drainage piping.
3. Body: No-hub, cast-iron soil pipe as required to match connected piping.
4. Closure Plug:
 - a. Bronze.
 - b. Countersunk head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as, or not more than, one size smaller than cleanout size.
5. Wall Access For Concealed Riser:
 - a. Round, flat, nickel-bronze, copper-alloy cover plate with screw.
6. Wall Access for Concealed Riser:
 - a. Square, stainless-steel wall-installation frame and cover.

N. EXECUTION

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

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- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. 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.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping in corrosive soils according to ASTM A 674 or AWWA C105/A 21.5.
- M. Plumbing Specialties:

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1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 2. Install drains in sanitary waste gravity-flow piping.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- O. Install sleeves and sleeve seals for piping penetrations of interior walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless, Cast-Iron Soil Piping Coupled Joints:
1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Joint Restraints and Sway Bracing:
1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
 - a. Provide axial restraint for pipe and fittings 8 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
 - b. Provide rigid sway bracing for pipe and fittings 8 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
 - c. Provide rigid sway bracing for pipe and fittings 8 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.3 SPECIALTY INSTALLATION

- A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in ODs.
 2. In Drainage Piping: Nonpressure transition couplings.

- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
1. Plumbing Fixtures: Connect waste 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 waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 48 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. Test sanitary waste 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.

- a. 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 waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure:
 - a. Test waste and vent piping except outside leaders on completion of roughing-in.
 - b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - c. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - d. 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.
 - a. 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.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. 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.
- C. Reinspection: Piping will be considered defective if it does not pass tests and inspections. Make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- E. All new and existing sanitary drainage systems to the point of service connection or termination outside the building footprint for storm drainage shall be completely cleared with a plumber's snake and flushed after a building is completed and prior to Substantial Completion..

3.7 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

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- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.
- F. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
 - 1. If drains are not covered and it is suspected that dirt, debris or trash has entered the drainage system, the interior drainage system shall be professionally cleaned to the Architect's satisfaction and at no expense to the Owner.

3.8 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil, waste and vent piping shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 230500 - COMMON WORK RESULTS FOR MECHANICAL

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 describes the common work requirements for the mechanical work included in Division 23 and applies to all sections of Division 23.

- B. DEFINITIONS

- C. Following are definitions of terms and expressions used in the Mechanical and Electrical Sections:

1. Provide: Furnish and install
2. Directed: Directed by the Architect or Engineer
3. Indicated: Indicated in Contract Documents
4. Concealed: Hidden from normal sight; includes items within furred spaces, pipe and duct shafts, above suspended ceilings and within return air plenums.
5. Exposed: Non concealed - Work within Equipment Rooms shall be considered exposed.
6. Exterior: Items being or situated outside. Items located within a crawl space shall be considered exterior.
7. Conditioned: Heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means, so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.
8. Piping: Includes pipes, fittings, valves, hangers, and accessories comprising a system.
9. Ductwork: Includes ducts, fittings, housings, dampers, hangers, air devices, and accessories comprising a system.

1.3 CODES, REGULATIONS, AND PERMITS:

- A. References to codes, standards, specifications, and regulations apply to the latest edition adopted by the jurisdiction where the project is located.

- B. All materials furnished and all work installed shall comply with the applicable rules, regulations, and recommendations of the following bodies:

1. International Building Code
2. International Existing Building Code
3. International Mechanical Code

4. International Plumbing Code
5. International Fire Code
6. International Energy Code
7. National Electric Code
8. National Fire Protection Association Standards
9. State Fire Marshal Regulations
10. Local Fire Marshal Regulations
11. ASHRAE Standards and Handbooks (Latest Editions)
12. Local Health Department
13. State Health Department
14. Local Utility Companies
15. Underwriters Laboratories
16. Owner's Insurance Underwriter Standards
17. Environmental Protection Agency

- C. Give all necessary notices, obtain all permits, and pay all fees and other costs, including those for utility connections or extensions in connection with the work. File all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction. Obtain all required certificates of inspection and deliver same to the Architect before request for acceptance and final payment for the work.

1.4 EQUIPMENT LIST

- A. Provide a spreadsheet list of all equipment provided with the drawing tag number or designation, name, manufacturer, model number, serial number and full electrical characteristics.
- B. This list shall be provided to the TAB agent, Commissioning Agent, BAS providers and to the Owner prior to beginning TAB work and as soon after all equipment is received on site.

1.5 EQUIPMENT START-UP AND INITIAL OPERATION

- A. No equipment shall be operated, for testing or trial use, before full compliance with the equipment manufacturers' specifications and instructions for the lubrication, alignment, direction of rotation, balance, and other applicable considerations.
- B. Particular care shall be taken to see that all equipment is completely assembled, properly lubricated, and all grease and oil cases and reservoirs have been filled to the correct level with the recommended lubricants.
- C. It is the Contractor's responsibility to place each item of equipment, installed by him, in operating condition. This responsibility includes all auxiliaries, piping, wiring, etc., the startup of each unit, and a check of its performance.

1.6 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Refer to Section 017900 "Demonstration and Training" for additional information.

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- B. Upon completion of all work and all tests, Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment.
- C. Contractor shall instruct the Owner's representative fully in the operation, adjustment, and maintenance of all equipment furnished.

1.7 SITE VISIT

- A. Prior to preparing the bid, it is recommended that the Contractor and subcontractors shall visit the site and familiarize themselves with all existing conditions, make all necessary investigations as to locations of utilities, and all other matters which can affect the work.
- B. No additional compensation will be made to the Contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.8 DRAWINGS

- A. The Contract Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Any offsets, rises, or transitions not shown on the drawings and required to provide a complete system shall be provided at no additional contract cost. Do not scale the drawings. Consult the Architectural and Structural drawings and details for exact location of structure and equipment; where same are not definitely located, obtain this information from the Architect.
- B. In the event of ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of work, or 2) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation.

1.9 ELECTRICAL WORK

- A. Under Division 23 MECHANICAL, provide the following items of electrical work which shall conform with the applicable requirements of the Electrical Division:
 - 1. Low voltage temperature control wiring.
 - a. Concealed wiring shall be installed in conduit.
 - b. Exposed wiring shall be installed in conduit.
 - c. Refer to Section 260533 - Raceways and Boxes for Electrical Systems for installation requirements.
 - 2. Interlock wiring for mechanical equipment and devices.
 - 3. IT/network cabling between the BAS and Owner/Agency IT network.
- B. Under Division 26 ELECTRICAL, provide:
 - 1. Power wiring, complete from power source to motor or equipment junction box, including power wiring through motor starters, power factor correction devices, and line

reactors. Power factor correction devices shall be provided under Division 23 and installed under Division 26.

2. Motor control centers or motor starter, panelboards.
3. All miscellaneous individual motor starters, unless noted or specified otherwise.

C. SINGULAR NUMBER

- D. Where any device or part of equipment is herein referred to in the singular number (such as "valve"), such reference applies to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to Section 013300 "Submittal Procedures" for additional information.
- B. All component parts of each items of equipment or device shall bear the manufacturers' name plate; giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate the maintenance or replacement. The name plate of a subcontractor or distributor will not be acceptable. Where Underwriters' Laboratories standards apply, material and equipment shall be approved by them and shall bear the UL Label.
- C. In specifying materials, three (3) general procedures are used. The three (3) classifications are as follows:
1. GROUP 1: When a material or equipment is specified by brand name or other identifying information and three (3) or more brands are named it is considered that any one (1) of the brands so named will perform as desired, and the Contractor shall base his proposal on one (1) of the named brands. The first brand named or identified basis of design shall be used as a standard. The other brands named shall be equal to the specified brand in all respects. If one (1) of the other brands named is used it shall be the Contractor's responsibility to verify proper clearances and fit of the substituted equipment.
 2. GROUP 2: When the material or equipment is specified with the phrase "...or approved equal..." after a brand name and other identifying information, it is intended that the brand name is used for the purpose of establishing a minimum acceptable standard of quality and performance and Contractor may base his bid proposal on any item which is in all respects equal to that specified and presents essentially the same appearance. It shall be the Contractor's responsibility to ensure proper fit and clearances of all substituted equipment.
 3. GROUP 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, American Society of Testing and Materials, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects to the referred "Standard Specification".
- D. It is distinctly understood: (1) that the Architect will use his own judgment in determining whether or not any materials, equipment or methods offered in substitution are equal to those

specified; (2) that the decision of the Architect on all such questions of equality is final; and (3) that all substitutions will be made at no increase in cost to the Owner.

- E. Upon receipt of written approval from Architect, Contractor may proceed with substitution providing Contractor assumes full responsibility for, and makes, at his own expense, any changes or adjustments in construction or connection with other work that may be required by the substitution of such materials, equipment or methods. In the event of any adverse decisions by the Architect no claim of any sort shall be made or allowed against the Owner.
- F. All pipe and fittings shall be from a domestic manufacturer.

2.2 INSTALLATION AND COORDINATION DRAWINGS

A. General

1. Prior to fabricating or installing work, the contractor shall prepare, submit and use composite installation and coordination drawings to assure proper coordination and installation of work. No installation or construction work shall begin until the coordination drawings are completed, submitted, and approved.
2. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems. Composite coordination drawings shall include new and existing elements, components, and systems.
3. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended.
4. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important to efficient flow of Work.
5. Consideration shall be made for scheduling, sequencing, movement, and positioning of large equipment into building during construction.
6. Indicate penetrations in floors, walls, and ceilings and their relationship to assembly construction, other penetrations and installations. Identify where additional bracing and offsets are required to comply with Contract Documents.
7. Indicate any required installation sequences to minimize cutting and patching.
8. Indicate all equipment and devices indicated on wiring diagrams and schematics. Where field connections are shown to factory-wired terminals include manufacturer's literature showing internal wiring
9. Coordination Drawing Organization: Organize coordination drawings as follows:
 - a. Underslab Plans: Show structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work.
 - b. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the work.
 - c. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical, electrical, plumbing and fire protection components, and related work. Locate components within ceiling plenum to accommodate architectural ceiling height and layout of light fixtures indicated on Drawings.

- d. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - e. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
10. Systems: Include, but do not necessarily limit to, the following:
- a. HVAC:
 - 1) All equipment and equipment supports.
 - 2) Size and bottom elevations of horizontal ductwork, including insulation, bracing, flanges, and support systems.
 - 3) Size and horizontal elevations of vertical ductwork, including insulation, bracing, flanges, and support systems.
 - 4) Ductwork, grilles, registers, diffusers, dampers, and access panels.
 - 5) Maintenance clearances (including tube and filter removal), insulation installation clearances.
 - 6) Any item that may impact coordination with other disciplines.
 - b. HVAC Piping:
 - 1) All equipment and equipment supports.
 - 2) Size and bottom elevations of horizontal piping, including insulation, bracing, flanges, and support systems. Notate code required slope elevations.
 - 3) Size and horizontal elevations of vertical piping, including insulation, bracing, flanges, and support systems.
 - 4) Connections to equipment, valve and trim locations, access panels.
 - 5) Maintenance clearances, valve steam clearances, insulation installation clearances
 - 6) Any item that may impact coordination with other disciplines.
 - c. Plumbing:
 - 1) Size and bottom elevations of horizontal piping, including insulation, bracing, flanges, and support systems. Notate code required slope elevations.
 - 2) Size and horizontal elevations of vertical piping, including insulation, bracing, flanges, and support systems.
 - 3) Maintenance clearances, valve steam clearances, insulation installation clearances
 - 4) Any item that may impact coordination with other disciplines.
 - d. Fire Protection:
 - 1) Size and bottom elevations of horizontal piping, including bracing, flanges, and support systems. Notate code required slope elevations.
 - 2) Size and horizontal elevations of vertical piping, including bracing, flanges, and support systems.

- 3) Connections to equipment, branch connections, drops and heads, valve and trim locations, access panels.
- 4) Maintenance clearances, valve steam clearances.
- 5) Any item that may impact coordination with other disciplines.

e. Electrical and Specialty Systems:

- 1) Runs of vertical and horizontal conduit 1-1/2 inches in diameter and larger and racks of smaller conduit are required.
- 2) Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
- 3) Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
- 4) Location of pull boxes and junction boxes, dimensioned from column center lines.
- 5) Any item that may affect coordination with other disciplines.

f. Framing: All king studs, headers, bracing, miscellaneous framing, and any items that may affect coordination with other disciplines.

B. Production of Coordination Drawings

1. Draw plans to a scale not less than 1/4 inch equals one (1) foot in AutoCAD or REVIT format. Include plans, sections, and elevations of proposed work. Dimension all work as specified and as required for coordinated installation.
2. Reproduction of any portion of the mechanical and electrical contract drawings for re-submittal as a shop drawing is strictly prohibited. Shop drawings produced in such a manner will be rejected and returned not reviewed. Installation and coordination drawings shall be to scale reflecting actual equipment sizes purchased for the project.
3. The Construction Manager shall obtain and provide in AutoCAD or REVIT the base background documents to each contractor to establish a common platform for each contractor to use for their design drawings. Coordination will be accomplished by each Contractor superimposing his work on drawings.
4. Contractor coordination meetings shall be held continuously until the coordination drawings are complete and approved by all parties. Meetings shall be scheduled as required to complete the drawings in a timely manner as to not impact the project schedule. Additional time or compensation shall not be awarded based on the complexity or effort required to complete the coordination drawings.
5. In the event of conflicts involving location and layout of work, unless otherwise directed the Construction Manager shall use the following priority to resolve the conflict:
 - a. Structure and partitions shall have highest priority.
 - b. Equipment locations and access
 - c. Ceiling systems and recessed light fixtures.
 - d. Gravity drainage lines.
 - e. Medium pressure ductwork and devices.
 - f. Large pipe mains, valves and devices.
 - g. Pneumatic tube and material conveying systems (where applicable)
 - h. Low pressure ductwork, diffusers, registers, grilles, dampers
 - i. Fire protection piping, devices and heads.

- j. Small piping, tubing, electrical conduit and devices. Conduits installed in corridors shall be maintained at least 6-9" above finished ceiling and similarly grouped and tightly spaced.
 - k. Access panels.
6. Any conflicts, etc., discovered in the coordination stages prior to Contractor(s) sign-off which cannot be resolved by the Contractor(s) shall be brought to the Architect's attention for resolution.

C. Submittals

- 1. Submit drawing files using Portable Data File (PDF) format. Include transmittal indicating that each specialty trade has signed-off on each submitted coordination drawing.
- 2. For each area, submit:
 - a. Composite overlay drawing of each area with all trades shown.
 - b. Individual trade drawing of each area, i.e. Reflected Ceiling Plan, HVAC Ductwork, HVAC Piping, Plumbing, Fire Protection, Electrical.
- 3. Consultant will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Consultant determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Consultant will so inform Contractor, who shall make changes as directed and resubmit.
- 4. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with architectural, structural, mechanical, electrical and other work.
- 5. Contractor is responsible for timely updates to the coordination drawings to indicate as-built conditions for their own work. Updates are required to include all changes regardless of the source or reason for the change, including changes initiated by the Owner, Architects or Engineers.

D. Installation

- 1. Any conflicts, etc., discovered after the created and submission of the coordination and installation drawings and during the installation of the Work will be the responsibility of the Contractor(s) to resolve with the approval of Architect. Any and all costs for these resolutions shall be solely the responsibility of the Contractor(s).
- 2. Work fabricated/installed prior to the completion of the coordination and installation drawings is performed at the Contractors own risk, and compensation of time/costs for corrections will not be awarded.
- 3. Any work installed that is not in conformance with final approved coordination and installation drawings shall be required to be removed and relocated, and compensation of time/costs for corrections will not be awarded.

2.3 FIRE-RATED PENETRATIONS

- A. Provide UL Listed fire penetration systems in openings in rated floors, walls, and other elements of construction. Provide UL listed fire penetration systems at all new and existing

pipe penetrations of new and existing rated construction within the area of work. Coordinate work of this section with all other trades necessary for the proper installation of the fire rated penetration systems.

- B. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications. Submit copies of manufacturer's specifications, recommendations, inspection requirements, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
- C. All fire penetration systems shall reference ASTM E814/UL 1479 - Fire Test of Through - Penetration Fire Stops.
- D. All systems shall be UL tested and listed in the UL Fire Resistance Directory.
- E. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one (1) year from date of substantial completion.
- F. 3M products have been specified as the penetration fire stop basis of design. Other manufacturer's systems are acceptable providing they meet the requirements set forth in this specification. The fire rated penetration systems shall be the products of one manufacturer to the maximum extent possible. The products of more than one manufacturer shall not be used as a combined seal.
- G. Provide materials classified by UL to provide fire stopping equal to time rating, both "F" and "T" ratings, of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814. Systems shall be smoke and air tight.
- H. Deliver material undamaged in manufacturer's clearly labeled, unopened containers identified with brand, type, grade, and UL label where applicable. Coordinate delivery with scheduled installation date to allow minimum storage time at site. Store material in clean, dry ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instruction.
- I. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- J. Furnish adequate ventilation if using solvent. Furnish forced air ventilation during installation if required by manufacturer. Keep flammable materials away from sparks or flame. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping resistance.

- K. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose, materials, rust, or other substances that may affect proper fitting, adhesion of the required fire resistance.
- L. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instructions. Seal holes or voids made by penetrations to ensure an effective smoke barrier. Where floor openings without penetrating items are more than four (4) inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor. Protect materials from damages on surfaces subject to traffic.
- M. Clean up spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- N. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by local inspectors and other trades.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. The quality of workmanship required, for each trade, in the execution of work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Architect and his decision as to acceptable quality is final.
- B. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.2 EQUIPMENT PERFORMANCE

- A. All equipment, devices, controls, and hardware shall be proven to operate successfully throughout the guarantee period. Systems shall be proven during all-weather seasons and be demonstrated to affect the design conditions at times. System components or equipment items that fail to consistently deliver the design conditions shall be removed and replaced as directed by the Architect. The cost of required equipment replacements shall be borne by the Contractor.
- B. All equipment shall be tested after installation and be proven to deliver the manufacturers quoted design capacity. When capacity is in question as deemed by the Architect, the Contractor shall perform a detailed and comprehensive field performance test to certify the equipment capacity. System effect or installed performance factors may not be applied to performance ratings unless they were previously included when the equipment was submitted for approval. Equipment that fails to deliver manufacturers quoted design capacity shall be removed and replaced at the Contractors expense.

- C. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.3 EQUIPMENT CONNECTIONS

- A. All equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, piping specialties, water seals, valves, and electric connections recommended by the manufacturer, required by code or required for proper operation shall be provided.

3.4 CUTTING AND PATCHING

- A. Cutting and patching associated with the work shall be performed in a neat and workmanlike manner. Existing surfaces, which are damaged by the Contractor, shall be repaired or provided with new materials. All patching shall be done with materials and methods similar to existing adjacent work, subject to approval of the Architect. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by reciprocating or rotary, non-percussive methods.
- B. Patching of areas disturbed by installation of new work shall match existing adjacent surfaces in material, texture, and color.

3.5 PROTECTION OF EXISTING WORK

- A. When working in and around the building, extreme care shall be exercised with regard to protection of the structure and mechanical services. Repair or replace, to the satisfaction of the Architect, any existing work damaged in the performance of the new work.

3.6 SURVEYS AND MEASUREMENTS

- A. Base all measurements (both horizontal and vertical) from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check correctness of same as related to the work. Verify locations of existing utilities and inverts of same prior to the start of any systems shown connecting to existing utilities.
- B. Should the Contractor discover any discrepancy between actual measurements or conditions, and those indicated, which prevent following good practice or the intent of the drawings and specifications, he shall notify the Architect and shall not proceed with his work until he has received instruction from the Architect.

3.7 WELDING

- A. Welding shall conform to current standards and recommendations of the National Certified Pipe Welding Bureau, with all South Carolina Occupational Safety and Health Acts, State, City and

County Fire Prevention Code Requirements, and NFPA Standard 241 including provision of appropriate portable fire extinguishers.

- B. Before assigning any welders to work covered by this specification, the Contractor shall provide the Architect with the names of pipe welders to be employed for the work, together with each welder's assigned number, letter, or symbol which shall be used to identify the work of that welder and which shall be affixed immediately upon completion of each weld. Contractor shall also submit, with the list of names, copies of each welder's certified qualification tests prescribed by the National Certified Welding Bureau or by other reputable testing laboratory using procedures covered in the American Society of Mechanical Engineers Building Construction Code, Section IX, "Qualification Standard Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators". Welders must be certified for all positions.
- C. If requested by the Architect, the Contractor shall submit identifying stenciled test coupons made by any welder in question. The Contractor shall require any welder to retake the tests when, in the opinion of the Architect, the work of the welder creates a reasonable doubt as to his proficiency. Tests, when required, shall be conducted at no additional expense to the Owner; and the welder in question shall not be permitted to work as a welder on this project until he has been recertified. Recertification of the welder shall be made to the Architect only after the welder has taken and passed the required test; welder must pass the test without benefit of retests in order to resume work as a welder on this project.
- D. Welding shall conform to the ANSI Code for Pressure Piping ANSI B31.9, Building Services Piping. The Contractor shall be responsible for the quality of welding and shall repair or replace any work not in accordance with these specifications. Contractor shall, without cost to the Owner, check welds by radiograph, ultrasonic testing, sectioning or a combination of these methods wherever there is a question raised by the Architect as to the quality of a weld. Examination of the questionable weld shall be in addition to other system tests specified. Welds shall have penetration complete to the inside diameter of the pipe. The recommended spacing and levels between ends of pipes prior to welding shall be used in all cases to assure full penetration.
- E. Welders on pressure piping shall be certified and carry their identification stamp with them. Welds on lines with operating pressures above 100 psig shall be stamped.

3.8 HANDLING AND STORAGE OF MATERIAL

- A. Proper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment and materials so that no equipment or materials are damaged.
- B. All equipment delivered to the job site shall be stored on pedestals, above the ground and under roof or other approved covering. All enclosures for equipment shall be weatherproof. All motors, drives, switchgear, panels, etc. which are not totally enclosed, that are involved in the work, shall be stored in a heated, dry, water protected area with a minimum temperature of fifty degrees (50) Fahrenheit. All valves shall be stored under roof on wood pedestals, above ground. All insulation shall be stored under roof or in trailers, adequately protected from the weather. The Contractor shall follow all written instructions and recommendations of the

manufacturer and all requirements of the Architect in oiling, protection and maintenance of equipment during storage. It shall be the Contractor's complete responsibility for the storage and care of the equipment and materials.

- C. If any equipment and/or materials are found to be in poor condition at the time of installation the Architect may, at his discretion, order the Contractor to furnish and install new equipment and/or material at no cost to the Owner.

3.9 COOPERATION WITH OTHER TRADES

- A. Mechanical trades shall give full cooperation to other trades and shall furnish in writing, with copies to Architect any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay. Exact location of all mechanical and equipment, devices, etc. in finished spaces shall be coordinated with Architectural reflected ceiling plans, elevations and details.

3.10 CLEANING AND PAINTING

- A. Thoroughly clean all exposed surfaces of equipment and material and leave in a neat, clean condition.
- B. Restore and touch-up factory finishes which have been damaged during construction.

3.11 ACCESSIBILITY

- A. Equipment shall be installed per manufacturer's recommended clearance guidelines with sufficient space for maintenance personnel service, operate, and maintain equipment.
- B. Locate all above ceiling equipment which must be serviced, operated, or maintained, in fully accessible positions to eliminate the need for access panels and doors. Equipment shall include, but not be limited to, valves, clean-outs, motors, controllers, dampers, drain points, etc.
- C. Where overhead equipment cannot be located above spaces with either no ceilings or removable acoustical ceiling tiles, contractor shall provide, as part of the contract and no expense to the Owner, fourteen (14) gauge painted steel access doors where required and/or where directed (color shall match ceiling).
 - 1. Access doors shall be Milcor or approved equal to suit material in which installed.
 - 2. Access doors installed in fire rated walls or shafts shall be labeled and shall match rating of the construction.
 - 3. Doors shall be of sufficient size to allow access to all components; minimum size shall be eighteen (18) inches by eighteen (18) inches.
 - 4. Doors in Toilet Rooms and Janitor's Closets shall be Type 304 stainless steel.
 - 5. All doors shall have cylinder locks operable from same key.
 - 6. Submit shop drawings for approval. Locations shall be coordinated with the Architect and indicated on the composite installation and coordination drawings

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- D. Equipment deemed inaccessible by the Architect shall be reworked by the Contractor at no expense to the Owner.

3.12 EQUIPMENT SUPPORTS

- A. Supports will be furnished and installed under this Division and shall be in accordance with Division 3.
- B. The Subcontractors shall furnish, to the General Contractor, all required templates for equipment supports.
- C. Under this Section, provide all equipment supports; consisting of structural members and related materials required for the mechanical and electrical work.
- D. The type and size of the supporting channels and supplementary steel shall be determined by the Subcontractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

3.13 DEMOLITION

- A. All existing piping, conduit, equipment, ductwork, and materials not required for re-use or re-installation shall be removed. Any existing materials and equipment which are removed and are desired by the Owner, or are indicated to remain the property of the Owner, shall be delivered to him on the premises by the Contractor where directed by the Architect. All other materials and equipment which are removed shall become the property of the Contractor and shall be removed by him from the premises.
- B. Existing piping that remains concealed, buried, or otherwise contained in the remaining slabs and walls shall be capped, plugged, or otherwise sealed. All pipes shall be cut so that their capped or plugged ends will be below the finished floors or behind finished surfaces.
- C. Existing wiring, where possible, shall be removed or pulled through conduits. Wiring remaining shall be cut back behind the termination of conduits so that conduits can be adequately capped, plugged, or sealed.

3.14 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. When existing mechanical work is removed, all pipes, valves, ducts, and materials shall be removed to a point below the finished floors or behind finished walls and capped. Such points shall be far enough behind finished surfaces to allow for the installation of the normal thickness of finished material.
- B. When the work specified hereinafter connects to existing equipment, piping, or ductwork, the Contractor shall perform all necessary alterations, cuttings, or fitting of existing work as may be necessary or required to make satisfactory connections between the new and existing work and to leave the completed work in a finished and workmanlike condition, to the entire satisfaction of the Architect.

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- C. When the work specified hereinafter or under other divisions of the contract necessitates relocation of existing equipment, piping, or ductwork, the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike condition, to the satisfaction of the Architect. All work resulting in an extra to the contract shall be approved by the Owner and Architect before proceeding.
- D. All cutting and patching necessary for the installation of the mechanical work shall be done under this Division. Any damage done to the work already in place shall be repaired at the Contractor's expense. Patching shall be uniform in appearance and shall match the surrounding surface.
- E. When the work specified hereinafter connects to existing piping, to avoid possible cross-connection of supply and return lines, the Contractor shall field verify the configuration of supply and return lines, using an appropriate temperature sensing or pressure device, before making final connections. Any discrepancy between construction documents and field verification should be promptly reported to the Architect before completing piping installation, so proper piping configuration can be verified.

3.15 INTERRUPTION OF EXISTING UTILITIES

- A. Notify the Owner in writing at least ten (10) calendar days in advance of any required shutdown of water, sewage, electrical service or other utility. Upon written receipt of approval from Owner, shutdowns shall be performed between the hours of six (6) p.m. and six (6) a.m. including clean-up or as directed otherwise and shall be accomplished at no additional cost.
- B. At the end of each interruption, all services shall be restored so that normal use of the building can continue.

END OF SECTION 230500

SECTION 230548 - VIBRATION AND SEISMIC 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 Specification Sections, apply to this Section.
- B. The International Building Code and ASCE/SEI 7 Standard apply to all work associated with the seismic installation of all new mechanical piping and equipment. Refer to Structural drawings and ASCE/SEI 7 for seismic and wind loads and additional information.

1.2 SUMMARY

- A. Section Includes:
 - 1. Snubbers.
 - 2. Restraint channel bracings.
 - 3. Restraint cables.
 - 4. Seismic-restraint accessories.
 - 5. Related Requirements:
 - 6. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
 - 7. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

- A. ASCE/SEI: American Society of Civil Engineers/Structural Engineering Institute
- B. IBC: International Building Code.
- C. ICC-ES: ICC-Evaluation Service.
- D. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

- a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Delegated-Design Submittal: For each seismic-restraint device.
1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the manufacturer's qualified professional engineer responsible for their preparation.
 - a. Provide approved submittals of all equipment and systems required to have seismic restraint to the seismic restraint provider for use in making calculations and selecting the appropriate seismic restraint devices and systems.
 2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select seismic restraints.
 - a. Seismic- Details:
 - b. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - c. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - d. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - e. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For situations where limited space necessitates maximum utilization for efficient installation of different components, show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: See Architectural front sheets.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: See Architectural front sheets.
 - a. Component Importance Factor: 1.5
 - b. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
 - c. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.
- B. SNUBBERS
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control, Inc
 - 2. Mason Industries, Inc.
 - 3. Novia; A Division of C&P
 - 4. Vibration Mountings & Controls, Inc

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- D. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.2 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
 - 4. Unistrut; Part of Atkore International
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Gripple Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Novia; A Division of C&P
 - 5. Vibration & Seismic Technologies, LLC
 - 6. Vibration Mountings & Controls, Inc.
- B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Novia; A Division of C&P

5. TOLCO
 6. Vibration & Seismic Technologies, LLC
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
 - C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
 - D. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Piping Restraints:

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1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross expansion and seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare testing agency test and inspection reports.

END OF SECTION 230548

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing air systems.
 - 2. Balancing hydronic piping systems.
 - 3. Testing, adjusting, and balancing equipment.
 - 4. Testing, adjusting, and balancing existing systems and equipment.
 - 5. Control system verification.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at the Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Submit TAB strategies and step-by-step procedures as specified in "Preparation" Article. Submit plan a minimum 30 days prior to the start of TAB work on-site.
- D. System Readiness Checklists: Submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.
 - a. Calibrate instruments at least every 12 months or more frequently if required by the instrument manufacturer. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

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- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, BAS provider, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Coordinate efforts and cooperation with the BAS provider and project Commissioning Agent. Refer to commissioning specifications for additional information.
- C. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 FIELD CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.9 WARRANTY

- A. Performance Warranty:
 - 1. If AABC standards are used, provide a warranty on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
 - 2. If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
- B. Warranty includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

2.1 TEST INSTRUMENTS

- A. Use instruments of equal or better quality than those described in the technical portions of AABC “National Standards for Total System Balance” and NEBB “Procedural Standard for Testing Adjusting and Balancing of Environmental Systems”.
- B. Instrumentation shall include, as a minimum, the following items of equipment:
 - 1. Pressure gauges and fittings.
 - 2. Dry bulb and wet bulb thermostats.
 - 3. Contact pyrometer.
 - 4. Portable flow meter and orifice plates.
 - 5. Pitot tube and manometers.
 - 6. Alnor Velometer with attachments.
 - 7. Amprobe.
 - 8. Tachometer.
 - 9. Hydromanometer.
 - 10. Ultrasonic flow meter.
 - 11. Special wrenches and tools.

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, available TAB specialists that may be engaged include, but are not limited to, the following:
 - 1. Carolina Air & Water Balancing Company, Inc.
 - 2. Hall Technology, Inc.
 - 3. KLG Jones, LLC.
 - 4. Palmetto Air & Water Balance, Inc.

3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.

- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and verify that equipment with functioning control are ready for operation.
- I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- K. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine operating safety interlocks and controls on HVAC equipment.
- N. Report deficiencies discovered before performance of TAB procedures.
- O. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.

- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.
 2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.
 - d. Systems are flushed, filled, and air purged.
 - e. Strainers are pulled and cleaned.
 - f. Control valves are functioning per the sequence of operation.
 - g. Shutoff and balance valves have been verified to be 100 percent open.
 - h. Pumps are started and proper rotation is verified.
 - i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
 - j. Variable-frequency controllers' startup is complete and safeties are verified.
 - k. Suitable access to balancing devices and equipment is provided.
- C. TAB specialist shall walk the project with the mechanical contractor and commissioning agent prior to the insulation of ductwork and mark, pre-drill, and cap test holes. Insulating contractor shall provide removable insulation covers at duct traverse test hole locations for major primary duct supply, return and exhaust.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111 or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230700 "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Locate disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Adjust the variable-air-volume systems as follows:
 1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
 2. Verify that the system is under static pressure control.
 3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.

- c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
 - g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
- a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
- a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
- a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
 - b. Verify that terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:
- a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.

- c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
- d. Mark final settings.
- e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
- f. Verify tracking between supply and return fans.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 1. Check liquid level in expansion tank.
 2. Check highest vent for adequate pressure.
 3. Check flow-control valves for proper position.
 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 5. Verify that motor starters are equipped with properly sized thermal protection.
 6. Check that air has been purged from the system.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Adjust pumps to deliver total design gpm.
 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust VFD speed setting and system balancing valves, starting at the valves closest to the pump and working out toward end of system, until proportionately balanced system is achieved at design flow with one or two balancing valves at the ends of the system at 100% open settings.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- B. Adjust flow-measuring devices installed in mains and branches to design water flows.
1. Measure flow in main and branch pipes.
 2. Adjust main and branch balance valves for design flow.
 3. Re-measure each main and branch after all have been adjusted.
- C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
1. Measure flow at terminals.
 2. Adjust each terminal to design flow.
 3. Re-measure each terminal after it is adjusted.
 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 5. Perform temperature tests after flows have been balanced.
- D. For systems with pressure-independent valves at terminals:
1. Measure differential pressure and verify that it is within manufacturer's specified range.
 2. Perform temperature tests after flows have been verified.
- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
1. Measure and balance coils by either coil pressure drop or temperature method.
 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- F. Verify final system conditions as follows:
1. Re-measure and confirm that total water flow is within design.
 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 3. Mark final settings.
- G. Verify that memory stops have been set.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
1. Verify that the differential-pressure sensor is located as indicated.
 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:

1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust VFD speed setting and system balancing valves, starting at the valves closest to the pump and working out toward end of system, until proportionately balanced system is achieved at design flow with one or two balancing valves at the ends of the system at 100% open settings.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
5. For systems without pressure-independent valves or flow-measuring devices at terminals:

- a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
6. Prior to verifying final system conditions, determine the system differential-pressure set point.
 7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 8. Mark final settings and verify that all memory stops have been set.
 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 10. Verify that memory stops have been set.
- D. For systems with diversity:
1. Determine diversity factor.
 2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
 3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 4. Adjust flow-measuring devices installed in mains and branches to design water flows.

- a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
- a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
6. For systems with pressure-independent valves at terminals:
- a. Measure differential pressure, and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
7. For systems without pressure-independent valves or flow-measuring devices at terminals:
- a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:
- a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
13. Verify that memory stops have been set.

3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first.
- B. Balance the secondary circuits after the primary circuits are complete.
- C. Adjust pumps to deliver total design gpm.

1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- D. Adjust flow-measuring devices installed in mains and branches to design water flows.
1. Measure flow in main and branch pipes.
 2. Adjust main and branch balance valves for design flow.
 3. Re-measure each main and branch after all have been adjusted.
- E. Adjust flow-measuring devices installed at terminals for each space to design water flows.
1. Measure flow at terminals.
 2. Adjust each terminal to design flow.
 3. Re-measure each terminal after it is adjusted.
 4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 5. Perform temperature tests after flows have been balanced.
- F. For systems with pressure-independent valves at terminals:
1. Measure differential pressure and verify that it is within manufacturer's specified range.
 2. Perform temperature tests after flows have been verified.
- G. For systems without pressure-independent valves or flow-measuring devices at terminals:
1. Measure and balance coils by either coil pressure drop or temperature method.
 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- H. Verify final system conditions as follows:

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1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

- I. Verify that memory stops have been set.

3.11 PROCEDURES FOR STEAM SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.
- C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- D. Check settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

3.12 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

3.13 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 1. Verify temperature control system is operating within the design limitations.
 2. Confirm that the sequences of operation are in compliance with Contract Documents.
 3. Verify that controllers are calibrated and function as intended.
 4. Verify that controller set points are as indicated.
 5. Verify the operation of lockout or interlock systems.
 6. Verify the operation of valve and damper actuators.
 7. Verify that controlled devices are properly installed and connected to correct controller.
 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.14 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.

- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet.

3.15 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 - 4. Cooling-Water Flow Rate: Plus 10 percent.

- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.16 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.17 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
 - 4. Provide PDF copies of draft and final reports for use in commissioning activities and for inclusion in closeout and systems manuals.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Manufacturers' test data.
 - 2. Field test reports prepared by system and equipment installers.
 - 3. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.

- c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following (if requested):
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
 8. Apparatus-Coil Test Reports:
 9. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 10. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.

- h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.
 - o. Inlet steam pressure in psig.
11. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 12. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- E. Air-Terminal-Device Reports:
1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft..
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- F. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

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1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.

2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.

G. Packaged Chiller Reports:

1. Unit Data:
 - a. Unit identification.
 - b. Make and model number.
 - c. Manufacturer's serial number.
 - d. Refrigerant type and capacity in gal.
 - e. Starter type and size.
 - f. Starter thermal protection size.
 - g. Compressor make and model number.
 - h. Compressor manufacture's serial number.

2. Water-Cooled Condenser Test Data: (Indicated and Actual Values):
 - a. Refrigerant pressure in psig.
 - b. Refrigerant temperature in deg F.
 - c. Entering-water temperature in deg F.
 - d. Leaving-water temperature in deg F.
 - e. Entering-water pressure in feet of head or psig.
 - f. Water pressure differential in feet of head or psig.

3. Air-Cooled Condenser Test Data (Indicated and Actual Values):
 - a. Refrigerant pressure in psig.
 - b. Refrigerant temperature in deg F.
 - c. Entering- and leaving-air temperature in deg F.

4. Evaporator Test Reports: (Indicated and Actual Values):
 - a. Refrigerant pressure in psig.
 - b. Refrigerant temperature in deg F.
 - c. Entering-water temperature in deg F.
 - d. Leaving-water temperature in deg F.

- e. Entering-water pressure in feet of head or psig.
 - f. Water pressure differential in feet of head or psig.
5. Compressor Test Data: (Indicated and Actual Values):
- a. Suction pressure in psig.
 - b. Suction temperature in deg F.
 - c. Discharge pressure in psig.
 - d. Discharge temperature in deg F.
 - e. Oil pressure in psig.
 - f. Oil temperature in deg F.
 - g. Voltage at each connection.
 - h. Amperage for each phase.
 - i. Kilowatt input.
 - j. Crankcase heater kilowatt.
 - k. Chilled-water control set point in deg F.
 - l. Condenser-water control set point in deg F.
 - m. Refrigerant low-pressure-cutoff set point in psig.
 - n. Refrigerant high-pressure-cutoff set point in psig.
6. Refrigerant Test Data: (Indicated and Actual Values):
- a. Oil level.
 - b. Refrigerant level.
 - c. Relief valve setting in psig.
 - d. Unloader set points in psig.
 - e. Percentage of cylinders unloaded.
 - f. Bearing temperatures in deg F.
 - g. Vane position.
 - h. Low-temperature-cutoff set point in deg F.
- H. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Unit make and model number.
 - d. Compressor make.
 - e. Compressor model and serial numbers.
 - f. Refrigerant weight in lb.
 - g. Low ambient temperature cutoff in deg F.
 - 2. Test Data: (Indicated and Actual Values):
 - a. Inlet-duct static pressure in inches wg.
 - b. Outlet-duct static pressure in inches wg.
 - c. Entering-air, dry-bulb temperature in deg F.
 - d. Leaving-air, dry-bulb temperature in deg F.

- e. Condenser entering-water temperature in deg F.
 - f. Condenser leaving-water temperature in deg F.
 - g. Condenser water temperature differential in deg F.
 - h. Condenser entering-water pressure in feet of head or psig.
 - i. Condenser leaving-water pressure in feet of head or psig.
 - j. Condenser water pressure differential in feet of head or psig.
 - k. Control settings.
 - l. Unloader set points.
 - m. Low-pressure-cutout set point in psig.
 - n. High-pressure-cutout set point in psig.
 - o. Suction pressure in psig.
 - p. Suction temperature in deg F.
 - q. Condenser refrigerant pressure in psig.
 - r. Condenser refrigerant temperature in deg F.
 - s. Oil pressure in psig.
 - t. Oil temperature in deg F.
 - u. Voltage at each connection.
 - v. Amperage for each phase.
 - w. Kilowatt input.
 - x. Crankcase heater kilowatt.
 - y. Number of fans.
 - z. Condenser fan rpm.
 - aa. Condenser fan airflow rate in cfm.
 - bb. Condenser fan motor make, frame size, rpm, and horsepower.
 - cc. Condenser fan motor voltage at each connection.
 - dd. Condenser fan motor amperage for each phase.
- I. Cooling Tower or Condenser Test Reports: For cooling towers or condensers, include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Make and type.
 - c. Model and serial numbers.
 - d. Nominal cooling capacity in tons.
 - e. Refrigerant type and weight in lb.
 - f. Water-treatment chemical feeder and chemical.
 - g. Number and type of fans.
 - h. Fan motor make, frame size, rpm, and horsepower.
 - i. Fan motor voltage at each connection.
 - j. Sheave make, size in inches, and bore.
 - k. Sheave dimensions, center-to-center and amount of adjustments in inches.
 - l. Number of belts, make, and size.
 - m. Pump make and model number.
 - n. Pump manufacturer's serial number.
 - o. Pump motor make and frame size.
 - p. Pump motor horsepower and rpm.
 - 2. Pump Test Data: (Indicated and Actual Values):

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- a. Voltage at each connection.
 - b. Amperage for each phase.
 - c. Water flow rate in gpm.
3. Water Test Data: (Indicated and Actual Values):
- a. Entering-water temperature in deg F.
 - b. Leaving-water temperature in deg F.
 - c. Water temperature differential in deg F.
 - d. Entering-water pressure in feet of head or psig.
 - e. Leaving-water pressure in feet of head or psig.
 - f. Water pressure differential in feet of head or psig.
 - g. Water flow rate in gpm.
 - h. Bleed water flow rate in gpm.
4. Air Data: (Indicated and Actual Values):
- a. Duct airflow rate in cfm.
 - b. Inlet-duct static pressure in inches wg.
 - c. Outlet-duct static pressure in inches wg.
 - d. Average entering-air, wet-bulb temperature in deg F.
 - e. Average leaving-air, wet-bulb temperature in deg F.
 - f. Ambient wet-bulb temperature in deg F.
- J. Heat-Exchanger/Converter Test Reports: For steam and hot-water heat exchangers, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
 - f. Ratings.
 2. Steam Test Data: (Indicated and Actual Values):
 - a. Inlet pressure in psig.
 - b. Condensate flow rate in lb/h.
 3. Primary Water Test Data: (Indicated and Actual Values):
 - a. Entering-water temperature in deg F.
 - b. Leaving-water temperature in deg F.
 - c. Entering-water pressure in feet of head or psig.
 - d. Water pressure differential in feet of head or psig.
 - e. Water flow rate in gpm.
 4. Secondary Water Test Data: (Indicated and Actual Values):

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- a. Entering-water temperature in deg F.
 - b. Leaving-water temperature in deg F.
 - c. Entering-water pressure in feet of head or psig.
 - d. Water pressure differential in feet of head or psig.
 - e. Water flow rate in gpm.
- K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- L. Boiler Test Reports:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.

- f. Fuel type and input in Btuh.
 - g. Number of passes.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
2. Test Data: (Indicated and Actual Values):
 - a. Operating pressure in psig.
 - b. Operating temperature in deg F.
 - c. Entering-water temperature in deg F.
 - d. Leaving-water temperature in deg F.
 - e. Number of safety valves and sizes in NPS.
 - f. Safety valve settings in psig.
 - g. High-limit setting in psig.
 - h. Operating-control setting.
 - i. High-fire set point.
 - j. Low-fire set point.
 - k. Voltage at each connection.
 - l. Amperage for each phase.
 - m. Draft fan voltage at each connection.
 - n. Draft fan amperage for each phase.
 - o. Manifold pressure in psig.
- M. Air-to-Air Heat-Recovery Unit Reports:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 3. If fans are an integral part of the unit, include the following for each fan:
 - a. Make and type.
 - b. Arrangement and size.
 - c. Sheave make, size in inches, and bore.
 - d. Sheave dimensions, center-to-center, and amount of adjustments in inches.

4. Test Data (Indicated and Actual Values):
 - a. Total exhaust airflow rate in cfm.
 - b. Purge exhaust airflow rate in cfm.
 - c. Outside airflow rate in cfm.
 - d. Total exhaust fan static pressure in inches wg.
 - e. Total outside-air fan static pressure in inches wg.
 - f. Pressure drop on each side of recovery wheel in inches wg.
 - g. Exhaust air temperature entering in deg F.
 - h. Exhaust air temperature leaving in deg F.
 - i. Outside-air temperature entering in deg F.
 - j. Outside-air temperature leaving in deg F.
 - k. Calculate sensible and total heat capacity of each airstream in MBh.

N. Domestic Hot Water Circulation Systems:

1. Schematic drawings/diagrams: Include plans and diagrams showing locations of all equipment included in the report.
2. Listings of balancing manufacturer and model, balancing valve settings, and differential pressure readings across the balancing valve.

O. Vibration Measurement Reports:

1. Date and time of test.
2. Vibration meter manufacturer, model number, and serial number.
3. Equipment designation, location, equipment, speed, motor speed, and motor horsepower.
4. Diagram of equipment showing the vibration measurement locations.
5. Measurement readings for each measurement location.
6. Calculate isolator efficiency using measurements taken.
7. Description of predominant vibration source.

P. Sound Measurement Reports: Record sound measurements on octave band and dBA test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms:

1. Date and time of test. Record each tested location on its own NC curve.
2. Sound meter manufacturer, model number, and serial number.
3. Space location within the building including floor level and room number.
4. Diagram or color photograph of the space showing the measurement location.
5. Time weighting of measurements, either fast or slow.
6. Description of the measured sound: steady, transient, or tonal.
7. Description of predominant sound source.

Q. Indoor-Air Quality Measurement Reports for Each HVAC System:

1. HVAC system designation.
2. Date and time of test.
3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
4. Room number or similar description for each location.
5. Measurements at each location.

6. Observed deficiencies.

R. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.18 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of the Architect, Owner's representative or Commissioning authority.
- B. Architect, Owner's representative or Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
- F. Prepare test and inspection reports.

3.19 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

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END OF SECTION 230593

SECTION 230700 - HVAC 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 insulation for the following HVAC services:
 - 1. HVAC piping.
 - 2. HVAC duct services.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail removable insulation at piping specialties.
 - 4. Detail removable insulation at equipment connections.
 - 5. Detail application at linkages of control devices.
 - 6. Detail field application for each equipment type.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

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1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 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.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in PART 3 - EXECUTION 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. Mineral-Fiber Blanket Insulation:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Manson Insulation Inc.
 - e. Owens Corning

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2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I without factory-applied jacket, Type II with factory-applied vinyl jacket or Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Compressed thermal conductivity (k-value) at 75 deg F shall be 0.25 Btu x in./h x sq. ft. x deg F or less. Minimum installed R-Value of 3.0 (hr•ft²•°F)/Btu per inch thickness.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Manson Insulation Inc.
 - e. Owens Corning
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Thermal conductivity (k-value) at 75 deg F shall be 0.23 Btu x in./h x sq. ft. x deg F or less.

G. Mineral-Fiber Board Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Manson Insulation Inc.
 - e. Owens Corning
2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Thermal conductivity (k-value) at 75 deg F shall be 0.23 Btu x in./h x sq. ft. x deg F or less.

H. INSULATING CEMENTS

I. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

J. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. For indoor applications, use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aeroflex USA, Inc.
 - 2. Armacell LLC
 - 3. Childers Brand; H. B. Fuller Construction Products
 - 4. Dow Corning Corporatio
 - 5. Eagle Bridges - Marathon Industries
 - 6. Foster Brand; H. B. Fuller Construction Products.
 - 7. Johns Manville; a Berkshire Hathaway company
 - 8. K-Flex USA
 - 9. P.I.C. Plastics, Inc.
 - 10. Mon-Eco Industries, Inc.
 - 11. Speedline Corporation
 - 12. Vimasco Corporation.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- E. MASTICS
- F. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- G. For indoor applications, use mastics that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Childers Brand; H. B. Fuller Construction Products
 - 2. Eagle Bridges - Marathon Industries
 - 3. Foster Brand; H. B. Fuller Construction Products.
 - 4. Knauf Insulation
 - 5. Mon-Eco Industries, Inc.
 - 6. Vimasco Corporation
- I. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.

- J. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: 60 percent by volume and 66 percent by weight.
 - 4. Color: White.

2.3 LAGGING ADHESIVES

- A. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Childers Brand; H. B. Fuller Construction Products
 - 2. Foster Brand; H. B. Fuller Construction Products.
 - 3. Vimasco Corporation
- C. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Color: White.

2.4 SEALANTS

- A. Use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Childers Brand; H. B. Fuller Construction Products
 - 2. Eagle Bridges - Marathon Industries
 - 3. Foster Brand; H. B. Fuller Construction Products.
 - 4. Knauf Insulation
 - 5. Mon-Eco Industries, Inc.
 - 6. Pittsburgh Corning Corporation
 - 7. Vimasco Corporation
- C. ASJ Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alpha Associates, Inc

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. TAPES
- D. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- E. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- F. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
2. Insulation Pins and Hangers:
3. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.
4. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
5. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
6. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
7. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.

8. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 9. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

2.9 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems 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.
 1. 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, duct and piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 GENERAL 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. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches 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.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

- d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD QUALITY CONTROL

- A. If workmanship is of questionable quality, the contractor shall perform tests and inspections as directed by the Architect.
- B. Tests and Inspections:

1. Inspect field insulated equipment, ductwork, pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 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. HVAC Piping Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
- C. HVAC Equipment Items Not Insulated: Unless otherwise indicated, do not install insulation on equipment that is factory insulated.
- D. HVAC Ducts Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Fibrous-glass ducts.
 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums and casings.
 5. Flexible connectors.
 6. Vibration-control devices.
 7. Factory-insulated access panels and doors.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return:
1. Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
 2. For piping smaller than 1 1/2 inches and located in partitions within conditioned spaces, reduction of the scheduled thickness by 1 inch shall be permitted, but not to a thickness less than 1 inch.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, supply-air and outdoor-air duct insulation shall be the following:

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1. Above Ceiling: Mineral-Fiber Blanket: 2 inches thick and 1-lb/cu. ft. nominal density.
2. Concealed, supply-air devices shall be the following:
3. Mineral-Fiber Blanket: 1 inch thick and 1-lb/cu. ft. nominal density.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Concealed:
 1. None.
- C. Ducts and Plenums, Concealed:
 1. None.

END OF SECTION 230700

SECTION 230900 – BUILDING AUTOMATION AND TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the documents, the more restrictive, the more extensive (i.e. more expensive) requirements govern.

1.2 SCOPE

- A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified.
- B. All controls shall be an extension of and connected to the existing MUSC Campus management system which is used for energy management. All setpoints and programs must be able to be modified and changed through the user interface without additional hardware or gateways.
- C. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer. The installing manufacturer shall certify in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer has supervised their installation. In addition, the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.
- D. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
- E. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes.

1.3 WORK BY OTHERS

- A. Mechanical contractor installs all wells, valves, taps, dampers, flow stations, etc. furnished by BAS manufacturer.
- B. Electrical Contractor provides:

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1. 120V power to all BAS and/or Temperature control panels. Where not shown on plans, locations shall be determined by the BAS contractor and coordinated with the Architect and electrical contractor.
2. Wiring of all power feeds through all disconnect starters to electrical motor.
3. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by BAS manufacturer

C. Products furnished but not installed under this section

1. Laboratory Airflow Control Device
2. Control Valves
3. Flow Switches
4. Pressure and Temperature Sensor Wells and Sockets
5. Flow Meters
6. Automatic Dampers

D. Products installed but not furnished under this section

1. Smoke Detectors

E. The control manufacturer shall cooperate with the air and water balancing agency in the performance of their work as required or directed.

1.4 QUALITY ASSURANCE

- A. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within 20 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.
- B. The manufacturer shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the BAS.
- C. The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of BAS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of BAS systems similar in size and complexity to this project.
- D. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- E. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.

1.5 SUBMITTALS

- A. Submit 10 complete sets of documentation in the following phased delivery schedule:
1. Valve and damper schedules
 2. Equipment data cut sheets
 3. System schematics, including:
 - a. sequence of operations
 - b. point names
 - c. point addresses
 - d. interface wiring diagrams
 - e. panel layouts.
 - f. system riser diagrams
 4. Auto-CAD compatible as-built drawings
- B. Upon project completion, submit operation and maintenance manuals, consisting of the following:
1. Index sheet, listing contents in alphabetical order
 2. Manufacturer's equipment parts list of all functional components of the system, Auto-CAD disk of system schematics, including wiring diagrams
 3. Description of sequence of operations
 4. As-Built interconnection wiring diagrams
 5. Operator's Manual
 6. Trunk cable schematic showing remote electronic panel locations, and all trunk data
 7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
 8. Conduit routing diagrams

1.6 WARRANTY

- A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after beneficial use.
- B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.
- C. The on-line support services shall allow the local BAS subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

1.7 IDENTIFICATION

- A. Identify control wires and compressed air piping with a distinctive number on a nonconducting tag attached to each end or at junction points or by color coding of that wire or tube. Designate on control diagram the identifying color and/or number or other identifying designation used.
- B. Identify all control equipment and devices, including panels, controllers, valves, and automatic dampers, etc., by a method approved by the Architect. Designations shall match those used on control diagrams and shop drawings.

PART 2 - PRODUCTS

2.1 DDC CONTROLLER FLOOR LEVEL NETWORK:

- A. This level communication shall support a family of application specific controllers and shall communicate with the peer to peer network through DDC Controllers for transmission of global data.

2.2 DDC & HVAC MECHANICAL EQUIPMENT CONTROLLERS

- A. The DDC & HVAC Mechanical Equipment Controllers shall reside on the Building Level Network.
- B. DDC & HVAC Mechanical Equipment Controllers shall use the same programming language and tools. DDC & HVAC Mechanical Equipment Controllers which require different programming language or tools on a network are not acceptable.
- C. DDC & HVAC Mechanical Equipment Controllers which do not meet the functions specified for DDC Controllers or for HVAC Mechanical Equipment Controllers are not acceptable.

2.3 DDC CONTROLLER

- A. DDC Controllers shall be a 16-bit stand-alone, multi tasking, multi user, real time digital control processors consisting of modular hardware with plug in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three (3) Floor Level Application Specific Controller Device Networks.
- B. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:
 - 1. Control processes
 - 2. Energy management applications
 - 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - 4. Historical/trend data for points specified

5. Maintenance support applications
 6. Custom processes
 7. Operator I/O
 8. Dial up communications
 9. Manual override monitoring
- C. Each DDC Controller shall support firmware upgrades without the need to replace hardware.
- D. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
- E. DDC Controllers shall provide a minimum two RS 232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
- F. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
1. Switches shall be mounted either within the DDC Controllers key accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
- G. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up to date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
- H. Each DDC Controller shall continuously perform self diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
- I. Isolation shall be provided at all peer to peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
1. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V
 2. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
 3. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
 4. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)
- J. Isolation shall be provided at all peer to peer panel's AC input terminals to suppress induced voltage transients consistent with:

1. IEEE Standard 587 1980
2. UL 864 Supply Line Transients
3. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

K. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real time clock and all volatile memory for a minimum of 60 days.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS 232C port, via telephone line dial in or from a network workstation PC.

2.4 HVAC MECHANICAL EQUIPMENT CONTROLLERS

A. HVAC Mechanical Equipment Controllers shall be a 12-bit stand-alone, multi tasking, multi user, real time digital control processors consisting of modular hardware with plug in enclosed processors.

B. Each HVAC Mechanical Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Dial up communications

C. Each HVAC Mechanical Equipment Controller shall support firmware upgrades without the need to replace hardware.

D. HVAC Mechanical Equipment Controllers shall provide a RS 232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.

E. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up to date verification of all point conditions without the need for an operator I/O device.

F. Each HVAC Mechanical Equipment Controller shall continuously perform self diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

- G. Isolation shall be provided at all peer to peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
 - 1. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V
 - 2. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
 - 3. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
 - 4. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)

- H. Isolation shall be provided at all peer to peer panel's AC input terminals to suppress induced voltage transients consistent with:
 - 1. IEEE Standard 587 1980
 - 2. UL 864 Supply Line Transients
 - 3. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

- I. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real time clock and all volatile memory for a minimum of 72 hours.
 - 1. Upon restoration of normal power, the HVAC Mechanical Equipment Controller shall automatically resume full operation without manual intervention.
 - 2. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS 232C port, via telephone line dial in or from a network workstation PC.

2.5 DDC & HVAC MECHANICAL EQUIPMENT CONTROLLER RESIDENT SOFTWARE FEATURES

- A. General:
 - 1. The software programs specified in this Section shall be provided as an integral part of DDC and HVAC Mechanical Equipment Controllers and shall not be dependent upon any higher level computer for execution.
 - 2. All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.
 - 3. All digital points shall have user defined two-state status indication (descriptors with minimum of 8 characters allowed per state (i.e. summer/winter).

- B. Control Software Description:
 - 1. The DDC and HVAC Mechanical Equipment Controllers shall have the ability to perform the following pre tested control algorithms:
 - a. Two position control
 - b. Proportional control
 - c. Proportional plus integral control

- d. Proportional, integral, plus derivative control
 - e. Automatic tuning of control loops
- C. DDC and HVAC Mechanical Equipment Controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.
- 1. Start Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period, and still maintain desired comfort conditions.
 - a. The SSTO program shall operate in both the heating and cooling seasons. It shall be possible to apply the SSTO program to individual fan systems. The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.
 - b. The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.
 - 2. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.
 - a. It shall be possible to individually command a point or group of points.
 - b. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start or stop within that group.
 - c. The operator shall be able to define the following information:
 - 1) Time, day
 - 2) Commands such as on, off, auto, and so forth.
 - 3) Time delays between successive commands.
 - 4) There shall be provisions for manual overriding of each schedule by an appropriate operator.
 - d. It shall be possible to schedule events up to one year in advance.
 - 1) Scheduling shall be calendar based.
 - 2) Holidays shall allow for different schedules.
 - 3. Night setback control: The system shall provide the ability to automatically adjust setpoints for night control.
- D. DDC and HVAC Mechanical Equipment Controllers shall be able to execute custom, job specific processes defined by the user, to automatically perform calculations and special control routines.
- 1. A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.

2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial up connection to a remote device such as a printer or pager.
 3. DDC and HVAC Mechanical Equipment Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task orientated information from the user manual.
 4. DDC and HVAC Mechanical Equipment Controller shall be capable of comment lines for sequence of operation explanation.
- E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC Mechanical Equipment Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC and HVAC Mechanical Equipment Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
 2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC and HVAC Mechanical Equipment Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start up. Users shall have the ability to manually inhibit alarm reporting for each point.
 3. Alarm reports and messages will be directed to a user defined list of operator devices or PCs based on time (after hours destinations) or based on priority.
 4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 5. In dial up applications, operator selected alarms shall initiate a call to a remote operator device.
- F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.
1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC and HVAC Mechanical Equipment Controllers point group. Two methods of collection shall be allowed: either by a pre defined time interval or upon a pre defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC and HVAC Mechanical Equipment Controller shall have a dedicated RAM based buffer for trend data and shall be capable of storing a minimum of ___ data samples. All trend data shall be available for transfer to a Workstation without manual intervention.
 2. DDC and HVAC Mechanical Equipment Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator initiated automatic and manual loop tuning algorithms shall be provided for operator selected PID control loops as identified in the point I/O summary.

- a. Loop tuning shall be capable of being initiated either locally at the DDC and HVAC Mechanical Equipment Controller, from a network workstation or remotely using dial in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

- G. DDC and HVAC Mechanical Equipment Controllers shall be capable of automatically accumulating and storing run time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.

- H. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC Mechanical Equipment Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC and HVAC Mechanical Equipment Controllers shall send alarm reports to multiple workstation without dependence upon a central or intermediate processing device. The peer to peer network shall also allow any DDC and HVAC Mechanical Equipment Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

- I. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.

2.6 LABORATORY AIRFLOW CONTROL

- A. Description: A laboratory airflow control system shall be furnished and installed to control the airflow into and out of laboratory rooms. This system shall be coordinated with the system as noted in other divisions of this specification. The exhaust flow rate of a laboratory fume hood shall be precisely controlled to maintain a constant average face velocity into the fume hood. The laboratory control system shall vary the amount of make-up/supply air into the room to operate the laboratories at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates, and maintain laboratory pressurization in relation to adjacent spaces (positive or negative.)

- B. Acceptable Manufacturers:
 - 1. Phoenix
 - 2. In accordance with this specification, alternative laboratory airflow control systems and equipment shall be considered for approval provided that the equipment be equal to the operational characteristics, capacities, and intent of control sequences specified herein. Approval to bid does not relieve the laboratory airflow control system supplier from complying with the minimum requirements or intent of this specification.

- C. The Laboratory Control System (LCS) shall be fully integrated to the HVAC Instrumentation and Controls System to maintain laboratory room supply and exhaust airflows, room ventilation rates, room static pressurization, room ambient temperatures & humidity's and the laboratory exhaust system functionality as specified herein.
- D. The LCS shall include all laboratory room supply and exhaust airflow terminals, fume hood airflow terminals, reheat coils, reheat coil valves, air terminal actuators, sensors, associated instrumentation and the control units and associated interconnecting wiring and pneumatic tubing. Any and all associated components required to implement a fully functioning and integrated system as specified herein shall also be provided. System verification and other documentation as specified under the Sections referenced herein shall also be included.
- E. All LCS data shall be capable of being accessed by authorized persons via the facility HVAC control system to obtain LCS data in graphical form as well as in specific user defined and configured LCS summary and status reports.
- F. Methods of integration shall be as defined elsewhere in this Section.
- G. Use new products that the manufacturer is currently manufacturing and that have been installed in similar installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner or Owner's representative. Spare parts shall be available for at least five years after completion of this contract.
- H. Laboratory Controllers
 - 1. Constant Volume Fume Hood Controllers
 - a. Provide a UL 916 listed controller where shown on drawings for constant volume-2 state (CV2) fume hoods. Exhaust air shall be controlled at two individual setpoints corresponding to switch/software command as indicated in Part 3, Sequence of Controls. The exhaust control process shall maintain exhaust at its respective setpoint in response to actual exhaust airflow measurement to ensure full pressure independent closed loop control using a proportional, integral and derivative (PID) control algorithm.
 - b. Controller shall be capable of receiving status override functions as defined the sequence of operation.
 - c. The controller shall provide a continuous signal to the Lab Room Controller indicating exhaust airflow to ensure stand-alone flow tracking. If the control function is directly connected to the Lab Room Controller, a dedicated controller is not required. Stand-alone controllers relying on the LAN or "assumed flows" for input to the Lab Room Controller are not acceptable.
 - d. Provide an Operator Display Panel (ODP) or Fume Hood Monitor for local alarming as specified under Part 2 of this specification.
 - 2. Constant Volume Fume Hood Monitor
 - a. Provide a fume hood alarm monitor for verification of safe hood operation. Device shall provide continuous monitoring of the fume hood face velocity or exhaust flow. Provide one of the following:

- 1) Exhaust Flow: The Operator Display Panel (ODP) shall interface with the CV2 fume hood controller and continuously display operating parameter measured. Information may be displayed as either Hi/Low or exhaust flow. The unit shall have visual lights indicating normal, marginal, and alarm conditions. An audible alarm shall be provided to indicate high and low conditions and emergency purge activation. Alarm type shall be indicated at the display. An emergency push-button allows the user to annunciate an emergency condition. The audible alarm shall be capable of being temporarily silenced. The following information shall be available to the BAS.
 - a) General failure
 - b) Exhaust flow
 - c) Exhaust flow setpoints
 - d) Uccopied/unoccupied status
 - e) Uccopied/unoccupied flow setpoints
 - f) Low and high flow warnings
 - g) Low and high flow alarms

- 2) Fume Hood Monitor: The fume hood monitor shall provide continuous measurement and display of the fume hood face velocity using through the wall thermal anemometer velocity technology. Unit shall have visual and audible annunciation whenever the measured face velocity exceeds the use defined alarm limits. Alarm type shall be indicated in the display. The audible alarm shall be capable of being temporarily silenced. An emergency push-button allows the user to annunciate an emergency condition. An unoccupied modes shall be available to eliminate unnecessary alarms when lab is not in use. The Fume Hood Monitor displayed face velocity shall be calibrated at three (3) different values to ensure the most accurate value possible for the range of sash openings and configurations The unit shall be provided with self diagnostics which notify the user of hardware failure. The following information shall be available to the BAS.
 - a) Face velocity
 - b) Low and high face velocity alarms
 - c) Low and high face velocity alarm limits
 - d) Occupied/unoccupied status
 - e) Alarm relay status
 - f) General failure
 - g) Horn silence status
 - h) Emergency mode status
 - i) External alarm point (DO) for loss of power indication
 - j) Three selectable points (DI) : sash height alarm, high velocity alarm disable, alarm point.

3. Constant Volume Auxiliary Exhaust Device Controllers
 - a. Provide a UL 916 listed controller where shown on drawings for constant volume-2 state (CV2) auxiliary exhaust devices (i.e., canopy hoods, snorkels etc). Exhaust air shall be controlled at two individual setpoints corresponding to switch/software

command as indicated in Part 3, Sequence of Controls. The exhaust control process shall maintain exhaust at its respective setpoint in response to actual exhaust airflow measurement to ensure full pressure independent closed loop control using a proportional, integral and derivative (PID) control algorithm.

- b. Controller shall be capable of receiving status override functions as defined in sequence of operations.
- c. The controller shall provide a continuous hardwired flow signal to the Lab Room Controller indicating exhaust airflow to ensure stand-alone flow tracking. If the control function is directly connected to the Lab Room Controller, a dedicated controller is not required.
- d. Provide an Operator Display Panel (ODP) located at the designated height near the exhaust device(s). The ODP will provide the following functions.
 - 1) Provide the switchover function for two-state control (i.e., occupied/unoccupied, on/off etc)
 - 2) Provide audible/visual alarm indication for exhaust airflow
 - 3) Provide a silence switch
 - 4) Provide an Emergency Purge pushbutton for implementing emergency operation as specified under Part 3, Sequence of Operation
 - 5) Provide an operator interface to the controller

4. Constant Volume Lab Room Controllers

- a. Laboratory room controllers shall provide closed loop pressure independent control of all laboratory room ventilation and ambient requirements. The laboratory room controller shall continuously monitor all the supply and auxiliary exhaust airflow devices including fume hoods in the room.
- b. Pressure control algorithm shall control supply and exhaust airflow devices in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. The offset shall be field adjustable and represents the volume of air which will enter (or exit) the room from the corridor or adjacent spaces
- c. Unless specifically indicated within Part 3, Sequence of Operation, volumetric offset shall be the only acceptable means of controlling room pressurization.
- d. All laboratory room controllers shall include all inputs and control outputs necessary to perform the specified control sequences.
- e. Upon a power failure or operational failure within the controller, the air terminal shall automatically be positioned to the predetermined fully open or fully closed (failsafe) position as indicated on the air terminal schedules in the project plans.

I. Laboratory VAV/CAV Air Terminals

- 1. Single Blade Damper or Venturi Air Valves are acceptable per the following requirements.
- 2. Single Blade Damper - Closed Loop Control.
 - a. Provide industrial grade Terminal Units with construction, leakage, and performance as stated within. Commercial grade terminal units are not acceptable. Units not conforming to all construction and performance criteria listed herein will be rejected.

- b. Laboratory Terminals shall have a single blade damper for airflow adjustment and shall provide the individual airflow capacities indicated in the project airflow schedules. Terminal airflow shall be pressure independently controlled using actual independent airflow measurement feedback as an integral part of a closed loop control process.
- c. Minimum airflow sensor measurement accuracy shall be +/- 5% of actual airflow over the entire design airflow range of each air terminal. Airflow measurement accuracy substantiation by a qualified independent test agency shall be available upon request.
- d. Airflow transmitter shall be factory mounted on the terminal and shall include the necessary signal conditioning/transmitter instrumentation to provide an output proportional to the velocity pressure. Transmitter shall have an accuracy of at least +/- 0.5% of the transmitter range and a drift no greater than 0.5% full scale/year. Transmitter ranges shall not exceed 0 to 1.00 Inches W.C. High and low limits shall be fully adjustable. Transmitters not meeting the drift requirements shall be provided with an auto-zero solenoid that connects to the air velocity pressure transducer's inlet ports for enabling automatic periodic re-calibration to ensure drift-free airflow measurement. Automatic re-calibration shall occur at a minimum every 24 hours without airflow disruption to the space.
- e. All single blade damper air terminals shall have a wide open pressure drop less than 0.25" wc at airflow equivalent to 2000 fpm inlet duct velocity.
- f. Room supply air terminals shall be industrial grade and constructed of 22 gauge galvanized steel with mechanically locked and gasketed seams and shall meet the mechanical standards of and be in compliance with UL 181 and UL 723, NFPA 90A, ESTM E84 and bacteria standard ASTM C665. Air terminal casings shall have 3/4" thick fiber-free closed cell foam insulation. Damper shafts shall be solid 1/2" diameter zinc-plated steel with self-lubricating polyethylene bushings and with external indication of the damper position. Damper blades shall be 22 gauge steel with a polyurethane foam gasket to enable tight shutoff for smoke control applications. Air terminal leakage shall not exceed 1% @ 6 inches W.C. positive static pressure of the airflow corresponding to 2000 fpm inlet duct velocity. Dampers 16" diameter and less shall be capable of a total shut off of room supply airflow (leakage to be less than 1% of airflow corresponding to 2000 fpm inlet duct velocity). Supply air terminals shall be provided with an averaging pitot tube array type of airflow sensor located upstream from all other air terminal components. Supply terminals shall be provided with integral hot water reheat coils comprised of copper tubing of 0.017" wall thickness and have heavy gauge sine wave coil fins for efficient heat transfer meeting scheduled capacities. The supply terminals shall be certified under ARI-880, and display the ARI label.
- g. Room general exhaust air terminals including the damper blades shall be industrial grade and constructed of minimum 20 gauge, Type 316L stainless steel with a baked on phenolic or Teflon coating. Damper shafts shall be 1/2" diameter stainless steel with self-lubricating Teflon bushings and with external indication of the damper position. Terminal air leakage shall not exceed 1% of design airflow @ 6 inches W.C. positive static pressure. Room general exhaust air terminals shall be provided with an orifice ring type of airflow sensor located upstream of the damper.
- h. All fume hood exhaust terminals shall be constructed of minimum 20 gauge, Type 316L stainless steel with a baked on phenolic or Teflon coating. Damper shafts shall be 1/2" diameter stainless steel with self-lubricating Teflon bushings and with

external indication of the damper position. Fume hood exhaust terminals shall be provided with an orifice ring type of airflow sensor located upstream of the damper. Airflow sensing techniques that are likely to become inoperative due to accumulation of particulate or chemical deposits or which can catch debris and obstruct exhaust airflow shall not be acceptable for fume hood exhaust applications. Unacceptable airflow measurement sensors for fume hood exhaust air terminals include pitot tubes, vortex shedders, thermal anemometers and other devices that protrude into the center of the exhaust air stream.

- i. Discharge and radiated sound power level data shall be provided for each different size and type of air terminal as part of the submittal documentation. Sound power data shall be obtained in accordance with ANSI/ASHRAE 130-1995 Standard Methods of Testing for Rating Ducted Air Terminal Units. All sound data shall be obtained by a qualified, accredited and ARI approved testing laboratory.

J. Venturi Air Valve

1. Laboratory control air valves shall consist of venturi type air valves and shall provide the individual airflow capacities indicated in the project airflow schedules. Airflow shall be pressure independently controlled using an actual independent airflow measurement feedback as well as a static pressure compensation spring as an integral part of a closed loop control process. The independent airflow signal shall be made available to the central building DDC system.
2. Airflow transmitter shall be factory mounted on the terminal and shall include the necessary signal conditioning/transmitter instrumentation to provide an output proportional to the velocity pressure. Transmitter shall have an accuracy of at least +/- 0.5% of the transmitter range and a drift no greater than 0.5% full scale/year. Transmitter ranges shall not exceed 0 to 1.00 Inches W.C. High and low limits shall be fully adjustable. Transmitters not meeting the drift requirements shall be provided with an auto-zero solenoid that connects to the air velocity pressure transducer's inlet ports for enabling automatic periodic re-calibration to ensure drift-free airflow measurement. Automatic re-calibration shall occur at a minimum every 24 hours without airflow disruption.
3. Manufacturers providing position feedback via potentiometer shall be allowed to provide two independent flow pressure switches indicating high and low flow conditions in lieu of an independent airflow station. High and low flow pressure switches shall be provided for all supply and exhaust valve types. In addition to the position feedback signal, both the high and low flow pressure switch signals shall be made available to the central building DDC control system for monitoring for safety and energy purposes. Include provisions for manual and automatic zeroing the differential pressure switches to ensure stable control and enable compensation for drift over time. Pressure switches shall meet the same drift requirements of the airflow transmitters specified above.
4. All venturi air valves shall be assembled and factory calibrated to provide pressure-independent control of airflow for any control arm setting between min and max positions for pressure drop across the valve between 0.6"wc and 3.0"wc. All venturi air valves shall have a minimum airflow sensor measurement and control accuracy of +/-5% of actual airflow over the design airflow range of each terminal.
5. Room supply venturi air valve terminals shall be industrial grade and constructed with an aluminum body and cone. The cone control shaft, control arm, brackets, clips, screws, nuts and all fittings that are within the air stream shall be of type 316L stainless steel. Room supply venturi air valve terminals shall be provided with an averaging pitot tube

- array type of airflow sensor located upstream from all other terminal components or combination flowfeedback/low-high alarm pressure switches specified above. Hot water reheat coils shall be comprised of copper tubing of 0.017" wall thickness and have heavy gauge sine wave coil fins for efficient heat transfer shall be provided by the venturi manufacturer with fittings required under related HVAC sections of the project specification.
6. Room general exhaust venturi air valve terminals shall be industrial grade and constructed with an aluminum body and cone. The cone control shaft, control arm, brackets, clips, screws, nuts and all fittings that are within the air stream shall be of type 316L stainless steel. Room general exhaust venturi air valve terminals shall be provided with an averaging pitot tube array or orifice type of airflow sensor located upstream from all other terminal components or combination position feedback/low-high alarm pressure switches specified above.
 7. All fume hood exhaust venturi air valve terminals shall be industrial grade and constructed with an aluminum body and cone and shall have a baked phenolic coating equivalent to Heresite®P403. The cone control shaft, control arm, brackets, clips, screws, nuts and all fittings that are within the air stream shall be of type 316L stainless steel. The cone control shaft and air valve components shall be Teflon-coated. Fume hood exhaust venturi air valve terminals shall be provided with an orifice ring type of airflow sensor located upstream from all other terminal components. Airflow sensing techniques that are likely to become inoperative due to accumulation of particulate or chemical deposits or which can catch debris and obstruct exhaust airflow shall not be acceptable for fume hood exhaust applications. Unacceptable airflow measurement sensors for fume hood exhaust air terminals include pitot tubes and other devices that protrude into the center of the exhaust air stream. Combination position feedback/low-high alarm pressure switches specified above may be provided in lieu of separate airflow stations as specified above
 8. All venturi air valves shall be factory calibrated to meet the specific airflow ranges indicated in the project airflow schedules. All venturi air valves shall also be factory tested to substantiate +/- 5% airflow control accuracy at the minimum and maximum rated airflow as well as at least six intermediate airflows between the minimum and maximum. In addition, each venturi air valve shall be tested to ensure pressure independent airflow within +/-5% at the minimum, maximum and at one half of the maximum static pressure drop ratings. All calibration and pressure independent airflow measurements shall be obtained using certified NIST traceable airflow measurement instruments. Each venturi air valve label shall include the valve tag number, serial number, part number; data from calibration of flow and actuator/control arm position and include the initials of the quality test technician. This information shall also be included with the as-built project documentation.
 9. Discharge and radiated sound power level data shall be provided for each different size and type of air terminal as part of the submittal documentation. Sound power data shall be obtained in accordance with ANSI/ASHRAE 130-1995 Standard Methods of Testing for Rating Ducted Air Terminal Units, except that air terminal inlet velocity shall accommodate the inherent lower maximum rate of a venturi air terminals as compared to traditional blade damper type air terminals. Sound Power Data shall be presented in accordance with the ARI 880-98 Standard for Air Terminals with the addition of an inlet airflow rate of 1000 fpm and a 1.5"w.c. pressure drop. All sound data shall be obtained by a qualified, accredited and ARI approved testing laboratory.
 10. Basis of Design: Phoenix Accel II

K. Laboratory Airflow Control System Description:

1. Laboratory room controllers shall provide closed loop pressure independent control of all laboratory room ventilation and ambient requirements. The laboratory room controller shall continuously monitor all the supply and auxiliary exhaust airflow devices including fume hoods in the room.
2. Pressure control algorithm shall control supply and exhaust airflow devices in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. The offset shall be field adjustable and represents the volume of air which will enter (or exit) the room from the corridor or adjacent spaces
3. Unless specifically indicated within Part 3, Sequence of Operation, volumetric offset shall be the only acceptable means of controlling room pressurization. Systems that rely on differential pressure as a means of control shall provide documentation that space pressurization can be maintained if fume hood sashes are changed at the same time a door to the space is opened.
4. Room ambient control (temperature, humidity etc.) and any other room control functions (lighting, IAQ etc.) shall be maintained by the controller as indicated in Part 3 Sequence of Operation
5. All laboratory room controllers shall include all inputs and control outputs necessary to perform the specified control sequences. Each laboratory room controller shall operate as a standalone unit, performing its specified control responsibilities independently. All input point and control output point databases as well as the control programs shall be stored in non-volatile EEPROM, EPROM and PROM memory, or a minimum of 100-hour battery backup shall be provided.
6. Momentary or extended losses of power shall not change or affect any laboratory room controller setpoints or stored data. Upon resumption of power the controller shall resume full normal operation exactly as before without any need for manual intervention. Upon a power failure or operational failure within the controller, the air terminal shall automatically be positioned to the predetermined fully open or fully closed (failsafe) position as indicated on the air terminal schedules in the project plans.
7. All laboratory room controllers shall include the ability to accept a minimum of two dry contact closure inputs from an auxiliary source into the room control sequence for such purposes as occupied/unoccupied ventilation changeover, emergency mode sequences, etc.
8. All laboratory room controllers shall provide a general alarm output that may be used for auxiliary signaling or notification..

L. Airflow Control Sound Specifications:

1. Unless otherwise specified the airflow control device shall not exceed the sound power levels in Table 1, Table 2, or Table 3.
2. If the airflow control device cannot meet the sound power level specification, a properly sized silencer or sound attenuator must be used. All silencers must be of a packless design (constructed of at least 18 gauge 316L stainless steel when used with fume hood exhaust) with a maximum pressure drop at the device's maximum rated flow rate not to exceed 0.20 inches of water.
3. All proposed airflow control devices shall include discharge, exhaust, and radiated sound power level performance.
4. Table 1. Exhaust Airflow Control Device Sound Power Level (Airborne)

| | Exhaust Sound Power Level in dB (re: 10⁻¹² watts) | | | | | |
|-------------------------------|---------------------------------------------------------------------|--------|--------|---------|---------|---------|
| Octave Band Number | 2 | 3 | 4 | 5 | 6 | 7 |
| Center Frequency in Hz | 125 Hz | 250 Hz | 500 Hz | 1000 Hz | 2000 Hz | 4000 Hz |
| 1000-50 cfm Device | | | | | | |
| 800 cfm @ 0.6" wc | 63 | 55 | 52 | 54 | 50 | 49 |
| 200 cfm @ 0.6" wc | 46 | 42 | 38 | 37 | 32 | 25 |
| 800 cfm @ 3.0" wc | 73 | 70 | 64 | 66 | 65 | 60 |
| 200 cfm @ 3.0" wc | 51 | 52 | 51 | 50 | 52 | 51 |
| 1500-100 cfm Device | | | | | | |
| 1200 cfm @ 0.6" wc | 65 | 58 | 53 | 56 | 52 | 52 |
| 400 cfm @ 0.6" wc | 50 | 45 | 38 | 39 | 37 | 31 |
| 1200 cfm @ 3.0" wc | 72 | 70 | 62 | 65 | 64 | 60 |
| 400 cfm @ 3.0" wc | 55 | 57 | 55 | 53 | 56 | 55 |
| 3000-200 cfm Device | | | | | | |
| 2400 cfm @ 0.6" wc | 63 | 56 | 55 | 58 | 54 | 55 |
| 800 cfm @ 0.6" wc | 51 | 45 | 41 | 42 | 39 | 34 |
| 2400 cfm @ 3.0" wc | 74 | 71 | 65 | 69 | 67 | 63 |
| 800 cfm @ 3.0" wc | 58 | 58 | 56 | 56 | 59 | 58 |

5. Table 2. Supply Airflow Control Device Sound Power Level (Airborne)

| | Discharge Sound Power Level in dB (re: 10⁻¹² watts) | | | | | |
|-------------------------------|-----------------------------------------------------------------------|--------|--------|---------|---------|---------|
| Octave Band Number | 2 | 3 | 4 | 5 | 6 | 7 |
| Center Frequency in Hz | 125 Hz | 250 Hz | 500 Hz | 1000 Hz | 2000 Hz | 4000 Hz |
| 1000-50 cfm Device | | | | | | |
| 800 cfm @ 0.6" wc | 62 | 57 | 54 | 58 | 54 | 51 |
| 200 cfm @ 0.6" wc | 45 | 46 | 42 | 44 | 40 | 34 |
| 800 cfm @ 3.0" wc | 72 | 71 | 67 | 75 | 72 | 68 |
| 200 cfm @ 3.0" wc | 53 | 56 | 54 | 58 | 56 | 54 |
| 1500-100 cfm Device | | | | | | |
| 1200 cfm @ 0.6" wc | 63 | 59 | 55 | 60 | 54 | 53 |
| 400 cfm @ 0.6" wc | 53 | 49 | 44 | 49 | 45 | 39 |
| 1200 cfm @ 3.0" wc | 72 | 73 | 69 | 77 | 72 | 68 |
| 400 cfm @ 3.0" wc | 58 | 63 | 61 | 63 | 60 | 57 |

| | | | | | | |
|---------------------|----|----|----|----|----|----|
| 3000-200 cfm Device | | | | | | |
| 2400 cfm @ 0.6" wc | 64 | 60 | 58 | 63 | 56 | 56 |
| 800 cfm @ 0.6" wc | 52 | 48 | 47 | 52 | 46 | 41 |
| 2400 cfm @ 3.0" wc | 75 | 75 | 72 | 78 | 73 | 70 |
| 800 cfm @ 3.0" wc | 59 | 62 | 62 | 66 | 62 | 60 |

6. Table 3. Supply Airflow Control Device Sound Power Level (Radiated)

| | Radiated Sound Power Level in dB (re: 10⁻¹² watts) | | | | | |
|-------------------------------|----------------------------------------------------------------------|--------|--------|---------|---------|---------|
| Octave Band Number | 2 | 3 | 4 | 5 | 6 | 7 |
| Center Frequency in Hz | 125 Hz | 250 Hz | 500 Hz | 1000 Hz | 2000 Hz | 4000 Hz |
| 1000-50 cfm Device | | | | | | |
| 800 cfm @ 0.6" wc | 44 | 41 | 45 | 41 | 36 | 34 |
| 200 cfm @ 0.6" wc | 33 | 28 | 31 | 29 | 26 | 20 |
| 800 cfm @ 3.0" wc | 53 | 53 | 56 | 57 | 55 | 53 |
| 200 cfm @ 3.0" wc | 41 | 38 | 41 | 39 | 39 | 37 |
| 1500-100 cfm Device | | | | | | |
| 1200 cfm @ 0.6" wc | 47 | 53 | 40 | 42 | 38 | 36 |
| 400 cfm @ 0.6" wc | 35 | 39 | 31 | 34 | 33 | 26 |
| 1200 cfm @ 3.0" wc | 52 | 60 | 54 | 60 | 59 | 53 |
| 400 cfm @ 3.0" wc | 42 | 44 | 43 | 46 | 46 | 42 |
| 3000-200 cfm Device | | | | | | |
| 2400 cfm @ 0.6" wc | 58 | 56 | 45 | 47 | 43 | 42 |
| 800 cfm @ 0.6" wc | 45 | 43 | 36 | 39 | 37 | 29 |
| 2400 cfm @ 3.0" wc | 69 | 68 | 60 | 65 | 63 | 57 |
| 800 cfm @ 3.0" wc | 54 | 53 | 48 | 51 | 50 | 48 |

M. Closed Loop Variable Frequency Drive:

1. The drive shall be a high performance pulse width modulated design which generates a sine-coded, adjustable voltage/frequency, three phase output for complete speed control of any conventional squirrel cage induction motor.
2. The device shall not induce any voltage line notching distortion back to the utility line. The device shall maintain a displacement power factor of not less than .95 throughout its speed range. Synchronism between drive frequency and motor speed shall be maintained under all conditions.
3. The drive shall automatically restart a coasting motor after a power outage of any duration without tripping or shutting down. The drive shall apply rated power to

accelerate the motor to the commanded speed within 0.5 second of the reapplication of drive power or the removal of a motor fault condition.

4. The drive shall accelerate the motor rapidly, limited only by the motor's rated torque and load.
5. An alarm circuit indicating low face velocity shall be included to electronically sense a loss of airflow via a drop in actual (not calculated) motor power or a difference between the actual and commanded motor speed. The alarm shall be enunciated through audible and visual means at the fume hood monitor.

N. Laboratory Control Unit:

1. A laboratory control unit shall control the supply and/or general exhaust airflow control devices to maintain proper room pressurization polarity (positive or negative.) Each individual laboratory shall have a dedicated laboratory control unit.
2. The control unit shall be electronic. The inputs shall accept linear feedback signals from fume hood, canopy, snorkel, biosafety cabinet, and office supply airflow control devices. The output signals shall control supply, general exhaust/return airflow control devices and/or variable frequency drives with signals that are linearly proportional to the desired supply or exhaust airflows.
3. The control unit shall maintain a constant design offset between the sum of the room's total exhaust and make-up/supply airflows. This offset shall be field adjustable and represents the volume of air which will enter (or exit) the room from the corridor or adjacent spaces.
4. The control unit shall provide linear signals that are proportional to all airflow sources, sash sensors, and flow alarms. The signals shall be available for hard wired connection to the facility's direct digital control (DDC) system, or through an integrated control unit that interfaces directly into the facility's DDC system.
5. The laboratory control unit may be either panel or valve mounted.
6. Refer to the DDC Control specification for the required input/output summary for the necessary points to be monitored and/or controlled.
7. Each laboratory shall have a dedicated 120 vac line connection to power the laboratory's airflow control system power supply.

O. Reheat Coils: Terminal unit shall be provided with a hot water reheat coil. Refer to Division 23. The control of the reheat coil shall be in conjunction with the terminal unit control. The terminal unit controller shall be responsible for the control of the reheat coil.

P. Installation: The automatic temperature controls (ATC) contractor shall install the sash sensors, interface boxes and fume hood monitor on the fume hood under initial supervision of the laboratory airflow control system supplier. Reel-type sash sensors and their stainless steel cables shall be hidden from view. Bar-type sash sensors shall be affixed to the individual sash panels. Sash interface boxes with interface cards shall be mounted in an accessible location.

1. The ATC contractor shall install the laboratory control unit (if panel-mounted) and wall-mounted power supply (as required) in an accessible location in the designated laboratory room.
2. The ATC contractor shall install 20 psi clean, dry, pneumatic supply air to all airflow control devices, except for constant volume devices.
3. The ATC contractor shall terminate and connect all cables as required. In addition, integrated laboratory control unit connectors shall be furnished by the ATC.

4. The mechanical contractor shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages.
5. The mechanical contractor shall provide and install all reheat coils and transitions.
6. The mechanical contractor shall provide and install insulation as required.
7. The electrical contractor shall wire a dedicated, single phase 120 vac power circuit to the laboratory control unit or power supply.

Q. System Start-Up and Training:

1. System start-up shall be provided by a factory-authorized representative of the laboratory airflow control system manufacturer. Start-up shall include calibrating the fume hood monitor and any combination sash sensing equipment as required. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, make-up, general exhaust, or return.)
2. The balancing contractor shall be responsible for final verification and reporting of all airflows.
3. The laboratory airflow control system supplier shall furnish a minimum of eight hours of Owner training, by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves, and general troubleshooting procedures.
4. Operation and Maintenance manuals, including as-built wiring diagrams and component lists shall be provided for each training attendee.

2.7 FLOOR LEVEL NETWORK APPLICATION SPECIFIC CONTROLLERS (ASC)

- A. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through Floor Level LAN Device Networks.
- B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor based, multi tasking, real time digital control processor. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.
- C. Terminal Equipment Controllers:
 1. Provide for control of each piece of equipment, including, but not limited to, the following:
 - a. Variable Air Volume (VAV) terminal units
 - b. Constant Air Volume (CAV) terminal units
 2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 psi pneumatic, 0-10v, allowing for interface to a variety of modulating actuators.
 3. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the FLN, BLN or MLN is not acceptable.

2.8 PERSONAL COMPUTER OPERATOR WORKSTATION HARDWARE (EXISTING)

- A. All new system software, graphics, point database information, and programming shall be added to the existing Personal computer operator workstation.

2.9 WORKSTATION OPERATOR INTERFACE (EXISTING)

A. Basic Interface Description

- 1. Operator workstation interface software shall minimize operator training through the use of English language prompting, 30 character English language point identification, on-line help, and industry standard PC application software. The software shall provide, as a minimum, the following functionality:
 - a. Real-time graphical viewing and control of environment.
 - b. Scheduling and override of building operations.
 - c. Collection and analysis of historical data.
 - d. Point database editing, storage and downloading of controller databases.
 - e. Alarm reporting, routing, messaging, and acknowledgment.

B. Dynamic Color Graphic Displays

- 1. Color graphic floor plan displays and system schematics for each piece of mechanical equipment shall be installed under this contract. Graphics to be created include:
 - a. Building floor plan with area temperatures displayed.
 - b. Each air terminal unit.

2.10 FIELD DEVICES

- A. Provide instrumentation as required for monitoring, control or optimization functions.

B. Room Temperature Sensors

- 1. Digital room sensors shall have LCD display, day / night override button, and setpoint slide adjustment override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment.

| | |
|-------------------------------|---------------------|
| Temperature monitoring range | +20°F to 120°F |
| Output signal | Changing resistance |
| Accuracy at Calibration point | +0.5°F |
| Set Point and Display Range | 55° to 95° F |

- 2. Liquid immersion temperature:

| | |
|-------------------------------|---------------------|
| Temperature monitoring range | +30°F to 250°F |
| Output signal | Changing resistance |
| Accuracy at Calibration point | +0.5°F |

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3. Duct (single point) temperature:

| | |
|-------------------------------|---------------------|
| Temperature monitoring range | +20°F to 120°F |
| Output signal | Changing resistance |
| Accuracy at Calibration point | +0.5°F |

4. Duct Average temperature:

| | |
|-------------------------------|----------------|
| Temperature monitoring range | +20°F to 120°F |
| Output signal | 4 – 20 mA DC |
| Accuracy at Calibration point | +0.5°F |
| Sensor Probe Length | 25 feet long |

C. Liquid Differential Pressure Transmitter

| | |
|-------------------------------|---------------------------------------------------------------------------------------------------------|
| Ranges | 0-5/30 inches H ₂ O 0-25/150 inches H ₂ O 0-125/750 inches H ₂ O |
| Output signal | 4 – 20 mA DC |
| Accuracy at Calibration point | Zero and span |
| Accuracy | ± 0.2% of span |
| Linearity | ±0.1% of span |
| Hysteresis | ±0.05% of span |

D. Differential pressure (Airflow):

| | |
|-------------------|-------------------------------------------|
| Set point ranges: | 0.5" WG to 1.0" WG 1.0" WG to 12.0" WG |
|-------------------|-------------------------------------------|

E. Static Pressure Sensor:

| | |
|-----------------------|-----------------------------------------------------------------------|
| Range | 0 to 0.5" WG 0 to 1" WG 0 to 2" WG 0 to 5" WG 0 to 10" WG |
| Output Signal | 4 – 20 mA VDC |
| Combined static error | 0.5% full range |
| Operating Temperature | -40°F to 175° F |

F. Air Pressure Sensor:

| | |
|-------|----------------------------------------------------------------------------------------------------------|
| Range | 0 to 0.1 " WG 0 to 0.25" WG 0 to 0.5 " WG 0 to 1" WG 0 to 2" WG 0 to 5" WG 0 to 10" WG |
|-------|----------------------------------------------------------------------------------------------------------|

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- | | |
|---------------|---------------------|
| Output Signal | 4 – 20 mA VDC |
| Accuracy | ±1.0% of full scale |
- G. Humidity Sensors:
- | | |
|-----------------|----------------|
| Range | 0 to 100% RH |
| Sensing Element | Bulk Polymer |
| Output Signal | 4 – 20 mA VDC |
| Accuracy | ± 2%RH at 77°F |
- H. Insertion Flow Meters (Equal to Onicon Series F-1200 or FB-1200)
- | | |
|----------------------------|------------------------------------------------------|
| Type: | Dual turbine. Provide bi-directional where required. |
| Sensing Method | Impedance Sensing |
| Accuracy | ± 2% of Actual Reading |
| Maximum Operating Pressure | 400 PSI |
| Output Signal | 4 – 20 mA |
- I. Pressure to Current Transducer
- | | |
|---------------|---------------------------------|
| Range | 3 to 15 psig or 3 to 30 psig |
| Output Signal | 4 – 20 mA VDC |
| Accuracy | ± 1% of full scale (± 0.3 psig) |
- J. Control Valves (all control valves shall have electric actuators)
- | | |
|----------------------|------------------------------------------------------------------------|
| Rangeability | 40:1 |
| Flow Characteristics | Modified. Equal percentage |
| Control Action | Normal open or closed as selected |
| Medium | Steam, water, glycol |
| Body Type | Valves 2” and smaller- screwed ends Valves 2½” and larger – flanged |
| Body Material | Bronze |
| Body Trim | Bronze |
| Stem | Stainless Steel |
| Actuator | 0-10 VDC Floating or 2 position 24 VAC/120VAC |
- K. Damper Actuators
1. Electric control shall be direct coupled actuators.
 2. Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.
 - a. The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½” diameter shaft or damper blade.

3. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.
4. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator's output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.
5. All actuators having more than a 100 lb-in torque output shall accept a 1" diameter shaft directly, without the need for auxiliary adapters.
6. All actuators shall be designed and manufactured using ISO9000 registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 1.
7. Damper actuators shall be able to stroke the dampers within 5 seconds for both main systems and terminal systems.
8. Damper fail positions shall be selected to fail to the last condition/position in order to maintain pressurization.

2.11 MISCELLANEOUS DEVICES

A. Thermostats

1. Room thermostats shall be of the gradual acting type with adjustable sensitivity.
2. They shall have a bi-metal sensing element capable of responding to a temperature change of one-tenth of one degree. (Provide all thermostats with limit stops to limit adjustments as required.)
3. Thermostats shall be arranged for either horizontal or vertical mounting.
4. In the vertical position thermostat shall fit on a mullion of movable partitions without overlap.
5. Mount the thermostat covers with tamper-proof socket head screws.

B. Current Sensing Relay:

1. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
2. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor.
3. Provide for status device for all fans and pumps.

C. Fire and Smoke Control Devices

1. Provide all smoke detection devices as required by NFPA Standard 90A and the International Building Code.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

- A. Provide a designated project manager who will be responsible for the following:
1. Construct and maintain project schedule
 2. On-site coordination with all applicable trades, subcontractors, and other integration vendors
 3. Authorized to accept and execute orders or instructions from owner/architect
 4. Attend project meetings as necessary to avoid conflicts and delays
 5. Make necessary field decisions relating to this scope of work
 6. Coordination/Single point of contact

3.2 INSTALLATION

- A. Provide control/power wiring and conduit to connect the automatic temperature control system and all HVAC system components for a complete operational system.
1. Provide wiring in accordance with the NFPA 70.
 2. Do not bury or conceal wiring beneath insulation.
 3. Locate wiring clear of access doors, accessible ceilings, lighting fixtures, walkways, or any location subject to damage or abrasion.
- B. Label or code each field wire at each end, and each controller and controlled device.
1. Identification shall be permanent, not subject to fading, flameproof, and approved by the Architect.
 2. Permanently mark terminal blocks at wire termination points.
 3. Identify each control device with an engraved laminated phenolic nameplate, white on black, lettering not less than 1/8 inch high, on 1 1/2 inch by 1 inch tag and brass interlocked chain secured to the control device. Name shall correspond with identification on the shop drawings.
 4. Identify sensors, controllers, relays, either mounted in local or central control panels, or remote mounted with a similar name tag as specified above. Attach to or adjacent to controllers with stainless steel or brass screws or rivets. Adhesives will not be acceptable. Do not attach to removable controller covers.
- C. Mount strap on sensors using helical screw stainless steel band clamps install strap on thermostats, aquastats and other temperature sensors on new piping only after the pipe surface is cleaned to bright metal. Strap on sensor may be used on piping up to 2 1/2 inch diameter. On pipe three (3) inches and larger pipe wells shall be used.
- D. Install valves in piping with stems as vertical as possible but in no case less than forty-five (45) degrees from vertical. For soldered or welded connections, remove valve internals before installation.

- E. Wire electric valves in accordance with NFPA 70 with not less than two (2) feet of flexible liquidtight connector with watertight bushings at the valve actuator and conduit termination. Brace conduit to the building structure to prevent movement and damage.
- F. Install pressure and temperature sensors as follows.
 - 1. Locate pressure and temperature sensing points sufficiently downstream from the control device to increase control loop time constant and minimize hunting.
 - 2. Locate shut off valves and three (3) valve bypasses as specified and as required to service sensors.
 - 3. Locate sensors where accessible for maintenance and replacement.
 - 4. Do not cover or conceal sensors with insulation.
- G. Locate each controller inside local field cabinets with instrumentation, pressure gauges, voltmeters or milliammeters to show, at the controller location, the condition of input power supply, input controller signal, and branch line signal. Indicators shall be permanently mounted.
- H. Provide wells for all sensors and indicators measuring temperatures in pressure vessels and piping.
 - 1. Wells shall be stainless steel or bronze to match media requirements.
 - 2. Verify working pressure of each sensor well installed.
 - 3. Do not install wells in extension couplings.
 - 4. Where pipe diameters are smaller than the well length, provide wells at piping elbow or tees to affect flow across the entire well area.
 - 5. Wells may face upstream or downstream.
 - 6. Install pipe wells above the horizontal to retain liquid heat transfer fluid in the well during assembly and maintenance
 - 7. If pipe wells restrict cross sectional pipe area to less than seventy (70) percent free area, provide pipe increases at the well not less than 150 percent pipe diameter.
- I. Dampers
 - 1. Mount dampers with the pivot rods in a horizontal position, except where suitable thrust bearings are provided, damper blade pivot rods may be a position other than horizontal.
 - 2. Mount operators outside of the duct or casing, on support plates that are completely outside the insulation and lagging. On casings or ducts handling cold air, install support plates in a manner that will prevent condensation on damper operator or on supports.

3.3 START-UP AND COMMISSIONING

- A. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the manufacturer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.
- B. Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

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- C. After manufacturer has completed system start-up and commissioning. Joint commissioning of integrated system segments shall be completed.
- D. A total of 80 man-hours shall be included in the project for the purpose of project commissioning.

3.4 ELECTRICAL WIRING AND MATERIALS

- A. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings, and related wiring accessories. All wiring shall be installed in conduit.
- B. Electrical work required for the control system shall be performed by and under the direction of the control manufacturer. All electrical work shall be performed in accordance with the requirements of Division 16, ELECTRICAL of this specification. Use materials specified in Division 16, ELECTRICAL for comparable application.
- C. Provide 120 volt, single phase, 60 hertz power to every BAS DDC Controller panel, HVAC/Mechanical Equipment Controller, PC console, power supply, transformer, annunciator, modems, printers and to other devices as required. The power supplies are to be extended in conduit and wire from normal power circuit breakers.
- D. Provide status function conduit and wiring for equipment covered under this Section.
- E. Provide conduit and wiring between the BAS panels and the temperature, humidity, or pressure sensing elements, including low voltage control wiring in conduit.
- F. Provide conduit and wiring between the PC workstation, electrical panels, metering instrumentation, indicating devices, miscellaneous alarm points, remotely operated contractors, and BAS panels, as shown on the drawings or as specified.
- G. All wiring to be compliant to local building code and the NEC.
- H. Provide electrical wall box and conduit sleeve for all wall mounted devices.

3.5 PERFORMANCE

- A. Unless stated otherwise, control temperatures within plus or minus 2°F, and humidity within plus or minus 2% of the set point and static pressure within 10% of set point.

3.6 COMMISSIONING, TESTING AND ACCEPTANCE (80 MAN-HOURS AS SPECIFIED)

- A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the owner and construction manager to

ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.

1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:
 - a. Sensor accuracy at 10, 50 and 90% of range.
 - b. Sensor range.
 - c. Verify analog limit and binary alarm reporting.
 - d. Point value reporting.
 - e. Binary alarm and switch settings.
 - f. Actuator ranges.
 - g. Fail safe operation on loss of control signal, electric power, network communications.
- B. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BMS program shall be put on line and commissioned. The contractor shall, in the presence of the owner and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.
- C. After all BMS programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:
 1. Data communication, both normal and failure modes.
 2. Fully loaded system response time.
 3. Impact of component failures on system performance and system operation.
 4. Time/Date changes.
 5. End of month/ end of year operation.
 6. Season changeover.
 7. Global application programs and point sharing.
 8. System backup and reloading.
 9. System status displays.
 10. Diagnostic functions.
 11. Power failure routines.
 12. Battery backup.
 13. Smoke Control, stair pressurization, stair, vents, in concert with Fire Alarm System testing.
 14. Testing of all electrical and HVAC systems with other division of work.
- D. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.

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- E. Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate all system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.
- F. The contractor shall supply all instruments for testing and turn over same to the owner after acceptance testing.
 - 1. All test instruments shall be submitted for approval.
 - 2. Test Instrument Accuracy:
 - Temperature: $\frac{1}{4}$ °F or $\frac{1}{2}\%$ full scale, whichever is less.
 - High Pressure: $\frac{1}{2}$ psi or $\frac{1}{2}\%$ full scale, whichever is less.
 - Low Pressure: $\frac{1}{2}\%$ full scale
 - Humidity: 2% RH
 - Electrical: $\frac{1}{4}\%$ full scale
- G. After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the owner may request that performance tests be repeated.

3.7 TRAINING

- A. The manufacturer shall provide factory trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The manufacturer shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.
- B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:
 - 1. Explanation of drawings, operations and maintenance manuals
 - 2. Walk-through of the job to locate control components
 - 3. Operator workstation and peripherals
 - 4. DDC controller and ASC operation/function
 - 5. Operator control functions including graphic generation and field panel programming
 - 6. Explanation of adjustment, calibration and replacement procedures
 - 7. Student binder with training modules
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Manufacturer. If such training is required by the Owner, it will be contracted at a later date.

3.8 TEMPERATURE CONTROL

- A. The sequences on the drawings describe the general intent of the control systems. Provide all devices, equipment, and wiring as required to perform the sequences described.

- B. Unless otherwise noted, size all automatic control valves for maximum ten (10) feet water pressure drop at maximum design flow rate.
- C. See plans for locations of all room thermostats, panels, dampers, valves, and equipment; where such devices are not indicated, however required by the sequences they shall be provided and located in the field by the Architect.
- D. Division 16 shall provide all detection devices (heat/smoke) as required by NFPA Standard 90A and the International Building and Mechanical Codes. The installation of detection devices and all control/power wiring for smoke detection devices and smoke dampers shall be provided under this section. Detection devices shall provide automatic shutdown of the HVAC systems in accordance with NFPA 90A.
- E. All temperature, humidity, pressure, and time set points shall be fully adjustable from the BAS.
- F. Where used to control both comfort heating and cooling, zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum. Variable air volume (VAV) terminal units shall be programmed to operate at the minimum airflow setting without addition of reheat when the zone temperature is within the set deadband.
- G. Provide all hardware, software, devices, equipment, and wiring as required to interface with the BAS.
- H. All two (2) position dampers shall be proven open by the use of end switches.

3.9 LABORATORY CONTROL SYSTEM SEQUENCE OF OPERATION

- A. Constant Volume Fume Hood
 - 1. This control sequence applies to constant volume or two position fume hoods in a manifold fume hood exhaust system to maintain the adjustable flow setpoint(s)
 - 2. Each fume hood has an individual exhaust terminal connected to a central fan.
 - 3. The fume hood control as defined herein can either be performed directly as inputs/outputs by the lab room controller or as a stand-alone controller. If a stand-alone controller is used, a hardwired signal indicating fume hood flow shall be provided to the lab room controller. Due to the criticality of the room pressure relationship, fume hood controllers sending flow information across a LAN to the room controller will not be accepted.
 - 4. When the room is in the occupied mode, the fume hood controller shall maintain the design occupied fume hood exhaust airflow setpoint.
 - 5. The fume hood unoccupied mode shall be in effect when its associated lab room is in unoccupied mode and when the fume hood sash is closed as indicated by the sash position switch.
 - 6. The fume hood controller shall maintain the design unoccupied fume hood exhaust airflow setpoint.
 - 7. The sash position switch point shall be available to the BAS for incorporation into a lab safety training program.
 - 8. The ODP shall provide an EMERGENCY PURGE pushbutton, which shall enable the user to increase fume hood exhaust airflow to maximum for a designated period of time.

After the designated time has expired the fume hood exhaust shall automatically reset to a lower level to prevent excessive demand on the exhaust system. The emergency purge shall also be able to be cancelled at any time by depressing the emergency purge button a second time. The ODP shall sound an audible alarm device whenever the emergency purge mode of operation is activated. The silence pushbutton on the ODP shall allow the user to silence the audible alarm device, which shall then remain silent until either the emergency purge operational mode is again activated, or an exhaust airflow alarm occurs.

9. The fume hood controller shall also be capable of an Emergency Mode based on input from the BAS and shall operate the same as indicated by the manual command by the ODP.
10. Momentary or extended losses of power shall not change or affect any fume hood controller setpoints or stored data. Upon resumption of power the fume hood controller shall resume full normal operation exactly as before without any need for manual intervention. Upon a power failure or operational failure within the fume hood controller, the fume hood exhaust air terminal shall be automatically positioned to the fully open (failsafe) position.

B. Constant Volume Canopy Hood

1. This control sequence applies to 2-state or constant volume point exhaust systems such as canopy hoods and snorkels ducted to a central exhaust system
2. Each device has an individual exhaust terminal connected to a central fan to maintain an constant flow or 2-state flow set points through inputs described below
3. The control as defined herein can either be performed directly as inputs to its associated lab room controller or as a stand-alone controller. If a stand-alone controller is used and actual flow through the device will not greatly affect the room pressurization, flow information can be supplied to the lab room controller via a LAN. If flow through the device is critical to the room pressurization, a hardwired signal indicating actual exhaust flow shall be provided to the room controller.
4. Exhaust airflow shall be controlled to its constant flow setpoint or the 2-state flow setpoints based on hardwired inputs from the remote switch where indicated on the drawing.
5. For critical flow devices, the remote switch will consist of an operator display panel (ODP) as described under the 2-state fume hood controller sequence.
6. Momentary or extended losses of power shall not change or affect any BSC controller setpoints or stored data. Upon resumption of power the BSC controller shall resume full normal operation exactly as before without any need for manual intervention. Upon a power failure or operational failure within the BSC controller, the BSC exhaust air terminal shall be automatically positioned to the fully open (failsafe) position.

C. VAV General Laboratory

1. General Description - Reference Mechanical Drawings
 - a. This control sequence applies to general laboratory spaces and support spaces with supply and exhaust laboratory airflow terminal devices for providing flow tracking pressurization control
 - b. Each room consists of a single supply and exhaust laboratory air terminal or multiple combinations.

2. Steady State Operation – Normal

- a. Steady state operation mode is designed to be around 12 air changes per hour as set through the balance of total exhaust in the room
- b. Ventilation control (ACH):
 - 1) The laboratory room controller shall continuously totalize all room exhaust airflows as the total room exhaust airflow. The laboratory room controller shall continuously calculate the difference between the total room exhaust airflow and the room exhaust airflow required to maintain the room air ventilation rate (air change per hour) as listed in the laboratory room schedule in the plans. Whenever the total room exhaust airflow is less than the room exhaust airflow required to maintain the room minimum ventilation rate, the laboratory room controller shall increase the room general exhaust airflow until the total room exhaust airflow equals the required room exhaust airflow.
 - 2) Whenever total room exhaust airflow is greater than the required room exhaust airflow, the laboratory room controller shall decrease the room general exhaust airflow until the total room exhaust airflow equals the required room exhaust airflow or the general exhaust airflow is reduced to its minimum value
 - 3) These sequences shall be able to be customized on site by adjusting parameters such as control loop algorithm gains, temperature setpoint, alarm limits, airflow differential setpoint, and pressurization mode.
- c. Pressurization control:
 - 1) The laboratory room controller shall continuously totalize all room exhaust airflows including fume hood exhausts, miscellaneous exhausts such as bench snorkels and the room general exhaust, as applicable to individual rooms, as the total room exhaust airflow. The laboratory room controller shall also continuously measure the room supply airflow
 - 2) The laboratory room controller shall continuously control the room supply airflow at value necessary to maintain the predetermined (adjustable) airflow tracking differential between the total room exhaust airflow and the room supply airflow as listed in the room airflow schedule on the project plans and/or determined by Test and Balance . For negatively pressurized rooms the room supply airflow shall always be maintained at a lower value than the total room exhaust airflow by the airflow tracking differential cfm (l/s). For positively pressurized rooms the room supply airflow shall always be maintained at a higher value than the total room exhaust airflow by the airflow tracking differential cfm (l/s).
- d. Temperature control:
 - 1) The laboratory room controller shall continuously measure the temperature in the room by means of the room temperature sensor. The laboratory room controller shall maintain the room temperature at its adjustable setpoint by initially modulating a normally closed, equal percentage, reheat valve. The room temperature control action shall utilize a proportional, integral and

- derivative (PID) closed loop control algorithm. The laboratory room temperature set point shall be established by authorized personnel through the plug-in, portable operator's terminal.
- 2) If room cooling needs increase when the reheat valve is fully closed, the laboratory room controller shall increase the room general exhaust airflow (when a general exhaust is present in the room) and the room supply airflow will increase to maintain the room temperature as well as the airflow tracking differential at the setpoint. If room cooling needs subsequently decrease, the laboratory room controller shall decrease both the room general exhaust and the supply airflow while still maintaining the room temperature setpoint and the room minimum airflow constraints.
 - 3) If the room supply airflow is at its minimum value and a further reduction in room cooling is needed, both the room supply airflow and room general exhaust airflow (when present) shall be held constant and the reheat valve shall be modulated as required to maintain the room temperature setpoint.

e. Temperature Control with BTU Compensation

- 1) The laboratory room controller shall continuously measure the temperature in the room by means of the room temperature sensor. The laboratory room controller shall also continuously measure the room supply air discharge temperature by means of a discharge air temperature sensor. The laboratory room controller shall maintain the room temperature at its adjustable setpoint by modulating a normally open, 3-way, equal percentage reheat valve. In addition, when a general exhaust is present in the room the room temperature shall be maintained at its adjustable set point by varying the room supply airflow and general exhaust airflows.
- 2) If room cooling needs increase while the reheat valve has been positioned to close off waterflow through the reheat coil, the laboratory room controller shall increase both the room general exhaust and the supply airflow (when a general exhaust is present in the room) to maintain the room temperature as well as the airflow tracking differential at the setpoint.
- 3) If room cooling needs subsequently decrease, the laboratory room controller shall decrease both the room general exhaust and the supply airflow as much as possible while still maintaining the room temperature setpoint and the room minimum airflow constraints. If the room ventilation rate is at its minimum value and a further reduction in room cooling is needed, the room supply airflow shall be held constant and the reheat valve shall be modulated to meet the room temperature setpoint.
- 4) To minimize a potential room temperature swing away from the room temperature setpoint the laboratory room controller shall also incorporate BTU compensation temperature control. Btu compensation shall be based upon continuously calculating the room's heating or cooling load in BTU's per hour based upon the difference between the room temperature and the supply air discharge temperature and room supply airflow. Whenever a significant change in the room supply airflow suddenly occurs, the laboratory room controller shall utilize BTU compensation control action to quickly raise or lower the room supply air discharge temperature to maintain the room's previous BTU's per hour cooling effect..

- 5) BTU compensation control action shall consist of immediately positioning the reheat valve to attain a new room supply air discharge temperature, which in combination with the new room supply airflow, shall maintain the room's previous BTU per hour cooling effect.. The room ambient temperature control with BTU compensation control action shall utilize a proportional, integral and derivative (PID) closed loop control algorithm.

f. Setback Mode

- 1) The room unoccupied/setback mode of ventilation control shall be in effect whenever scheduled room unoccupancy criteria (i.e., time of day, day of week, date, etc.) is in effect and/or an input to the laboratory room controller intended to indicate unoccupancy/setback is present.
- 2) When in the unoccupied/setback mode of control, the room ventilation rate and the room ambient parameters shall be controlled as indicated in the room ventilation schedule in the project plans. When in the unoccupied mode of control, the room pressurization control sequence shall remain in effect and each VAV fume hood in the room shall continue to have its face velocity and minimum fume hood exhaust maintained as listed in the fume hood schedule in the project plans.
- 3) Setback mode shall be determined by occupancy sensors (provide as required) and light switch.

g. Degrade Operation – Air flow control

- 1) If the central exhaust system is loaded to the extent that the general exhaust or fume hood exhaust flows fall short of the setpoint, the controller shall continue to maintain the scheduled offset between total supply and total exhaust flow.

END OF SECTION 230900

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
 - 1. Copper tube and fittings.
 - 2. Steel pipe and fittings.
 - 3. Joining materials.
 - 4. Dielectric fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe.
 - 2. Fittings.
 - 3. Joining materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Hot-Water Heating Piping: 125 psig at 250 deg F.
 - 2. PIPING MATERIALS
- B. 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 and ASTM B 88, Type M water tube, drawn temper.
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Copper Push-on-Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Elkhart Products Corporation
 - c. Mueller Industries, Inc.
 - d. NIBCO INC.
 - e. Viega LLC
 - 2. Description:
 - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
 - b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150.
- C. Malleable-Iron Unions: ASME B16.39; Classes 150.
- D. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

- E. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.

- F. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company

 - 2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

 - 3. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.4 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- B. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. WATTS
 - b. Wilkins
 - c. Zurn Industries, LLC

 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 150 psig minimum at 180 deg F.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Q. Install shutoff valve immediately upstream of each dielectric fitting.
- R. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

- S. Install sleeves for piping penetrations of walls, ceilings, and floors.
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.3 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4: Maximum span, 7 feet.
 - 2. NPS 1: Maximum span, 7 feet.
 - 3. NPS 1-1/2: Maximum span, 9 feet.
 - 4. NPS 2: Maximum span, 10 feet.
 - 5. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 6. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 7. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 8. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 9. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 10. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. 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.
- D. Push-on Joints for Copper Tubing: 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.
- E. 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.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.5 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections.

3.6 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Provide equipment bypasses to isolate components from piping where metal slag and filings are prone to collect (such as chillers, boilers, air handling units, fan coil units, air terminal units, etc). If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure or a minimum of 100 pounds per square inch gauge (psig), whichever is greater. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.
7. Contractor shall provide minimum 48 hours notice prior to testing to allow the Architect, Engineer, Commissioning Agent, Owner or his representative the opportunity to attend.
8. Tests shall be conducted and written report of testing submitted before any insulation is installed. Insulation installed prior to tests shall be removed.

C. Perform the following additional tests on welded piping:

1. Ultrasonically test ten (10) of the full penetration field welds in the chilled water supply and return systems. Testing shall be performed by a qualified independent testing contractor. All fillet and socket welds shall be visual and dye penetrant examined on the completed weld by a qualified individual.
2. Provide documentation of each inspection of accepted or rejected welds. Provide report results within three working days for satisfactory results and one working day for unsatisfactory tests
3. If any two (2) welds fail, all welds will be ultrasonically tested and repaired as required at the Contractor's expense.
4. Remove weld defects by grinding or chipping and repair or replace weld joints in accordance with approved procedures. Restart all repaired joints.

D. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).

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5. Set temperature controls so all coils are calling for full flow.
6. Verify lubrication of motors and bearings.

3.7 PIPING SCHEDULE

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
 2. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.
 3. Schedule 40, Grade B steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

END OF SECTION 232113

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

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1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Factory- and shop-fabricated ducts and fittings.
2. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
3. Elevation of top and bottom of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through partitions.
9. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
10. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

- A. Comply with requirements in "Duct Schedule" Article for applications of duct material, pressure class, duct seal-class level, and duct-leakage class.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials

involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DUCT LINER

- A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC
 - c. Ductmate Industries, Inc
 - d. Evonik Foams
 - e. K-Flex USA
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

- a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive and Exterior Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Ductmate Industries, Inc
 - 3. Hilti, Inc.
 - 4. Kinetics Noise Control, Inc
 - 5. Mason Industries, Inc.
 - 6. Unistrut; Part of Atkore International
 - 7. Vibration & Seismic Technologies, LLC
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service, the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

- D. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Sizes shown on plans are air side sizes. Where ducts are shown as lined, dimensions shall be increased to reflect that thickness of the lining.
- D. Install ducts in maximum practical lengths.
- E. Install ducts with fewest possible joints.
- F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- G. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- K. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 DUCT SEALING

- A. Ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A, as required to meet the requirements of ASHRAE/IES 90.1.

- B. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage.
- C. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment.
- D. Spiral lock seams need not be sealed.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Concealed From View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.
 - 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

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- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service, the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner.
 - 1. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.
- B. Paint materials and application requirements are specified in Division 09.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - b. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 3. Test for leaks before applying external insulation.
 - 4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - 5. Give seven days' advance notice for testing.

- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.8 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply Air Ducts:
 - 1. Ducts Connected to Multi-Zone Air-Handling Units, downstream, from air handling units to terminal units:
 - a. Concealed: Single wall, round, oval or rectangular as shown on drawings.
 - b. Exposed to View: Double wall, round, oval or rectangular as shown on drawings.
 - c. Pressure Class: Positive 6-inch wg.
 - d. SMACNA Seal Class: A.
 - e. SMACNA Leakage Class for Rectangular: 4.
 - f. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 2. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units, downstream, from unit to air device:
 - a. Concealed: Single wall, round, oval or rectangular as shown on drawings.
 - b. Exposed to View: Double wall, round, oval or rectangular as shown on drawings.
 - c. Pressure Class: Positive 2-inch wg.
 - d. SMACNA Seal Class: A.
 - e. SMACNA Leakage Class for Rectangular: 4.
 - f. SMACNA Leakage Class for Round and Flat Oval: 2.
- C. Return Air and Transfer Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Single wall, round, oval or rectangular as shown on drawings.
 - b. Pressure Class: Positive or negative 2-inch wg.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - 2. Elbow Configuration:

3. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

4. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Duct-mounted access doors.
 - 3. Duct access panel assemblies.
 - 4. Flexible ducts.
 - 5. Duct accessory hardware.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.

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- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Low-Leakage, Steel, Manual Volume Dampers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a Mestek Architectural Group company
 - b. McGill AirFlow LLC
 - c. Nailor Industries Inc
 - d. Pottorff
 - e. Ruskin Company
 - f. Trox USA Inc.
 - g. United Enertech
 - h. Vent Products Co., Inc
- 2. Comply with AMCA 500-D testing for damper rating.
- 3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- 4. Suitable for horizontal or vertical applications.
- 5. Frames:
 - a. Hat shaped.
 - b. 0.094-inch- thick, galvanized sheet steel.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 6. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch thick.
- 7. Blade Axles: 1/2-inch- diameter; galvanized steel hex-shaped.
- 8. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 9. Blade Seals: Vinyl.
- 10. Jamb Seals: Cambered stainless steel.
- 11. Tie Bars and Brackets: Galvanized steel.

12. Accessories:

- a. Include locking device to hold single-blade dampers in a fixed position without vibration.

B. Low-Leakage, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Warming and Ventilating; a Mestek Architectural Group company
- b. McGill AirFlow LLC
- c. Nailor Industries Inc
- d. Pottorff
- e. Ruskin Company
- f. Trox USA Inc.
- g. United Enertech
- h. Vent Products Co., Inc

2. Comply with AMCA 500-D testing for damper rating.

3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

4. Suitable for horizontal or vertical applications.

5. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

- a. Multiple or single blade.
- b. Parallel- or opposed-blade design.
- c. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

7. Blade Axles: Galvanized steel.

8. Bearings:

- a. Molded synthetic.
- b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Vinyl or neoprene.

10. Jamb Seals: Cambered aluminum or stainless steel.

11. Tie Bars and Brackets: Galvanized steel or aluminum.

12. Accessories:

- a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 0.5-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cesco Products; a division of MESTEK, Inc.
2. Ductmate Industries, Inc
3. Flexmaster U.S.A., Inc
4. Greenheck Fan Corporation
5. McGill AirFlow LLC
6. Nailor Industries Inc
7. Pottorff
8. United Eneritech
9. Ventfabrics, Inc
10. Ward Industries; a brand of Hart & Cooley, Inc

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

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1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.5 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M
 2. Ductmate Industries, Inc
 3. Flame Gard, Inc
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.6 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Castco – Model SF-181M.
 2. Thermaflex – Model MKE
 3. JPL – Model AMR.
- B. Insulated, Acoustical Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 6-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 175 deg F.
 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.
- C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Liquid adhesive plus sheet metal screws and tape.

D. Flexible Duct Elbow Supports:

1. Universal-mount, 1-piece, fully adjustable, radius-forming brace to support 4-inch through 16-inch diameter flexible air ducts.
2. Classified: UL 2043.
3. Material: 100 percent recycled copolymer polypropylene.
4. Support Frame Radius: 8 inches.
5. Compliance for Flexible Duct Radius:
 - a. SMACNA HVAC Duct Construction Standards.
 - b. ASHRAE Advanced Energy Design Guides.
 - c. ADC Flexible Duct Performance and Installation Standards.

2.7 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
 2. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- D. Mark the locations of all above-ceiling duct mounted dampers with orange non-adhesive surveyors flagging tape.

- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream and downstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. Control devices requiring inspection.
 - 8. Elsewhere as indicated.
- G. Install access doors with swing against duct static pressure.
- H. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- I. Label access doors.
- J. Install flexible connectors to connect ducts to equipment.
- K. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- L. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- M. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- N. Connect flexible ducts to metal ducts with draw bands or adhesive plus sheet metal screws.
- O. Make bends in flexible ducts with minimum of 1-duct diameter centerline radius.
- P. Where flexible ductwork is used as an elbow, provide flexible, durable duct elbow supports over outer jacket of flexible ducts to form smooth, 90-degree bends to eliminate flexible duct kinks and airflow restrictions.
- Q. Install duct test holes where required for testing and balancing purposes.

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- R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.
6. Test duct smoke detectors per NFPA 72. Detectors that use sampling tubes shall be tested to ensure that they will properly sample the airstream in the duct using a method acceptable to the manufacturer or in accordance with their published instructions. Preferred method is to use a manometer to measure the differential pressure between the two sampling tubes. Verifying the differential pressure is within the manufacturer documented acceptable levels.
7. Test all new fire, smoke and combination fire/smoke dampers both at project completion as well as at the end of the one-year warranty period. Contractor shall provide the test results for both tests on the standard damper testing form.

END OF SECTION 233300

SECTION 233600 - AIR TERMINAL UNITS

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. Shutoff, single-duct supply air terminal units.
- 2. ACTION SUBMITTALS

B. Product Data: For each type of air terminal unit.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
- 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings: For air terminal units.

- 1. Include plans, elevations, sections, and mounting details.
- 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- 3. Include diagrams for power, signal, and control wiring.
- 4. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

- 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Instructions for resetting minimum and maximum air volumes.
 - b. Instructions for adjusting software set points.

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1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of terminal units that fail in materials or workmanship within specified warranty period.
 - 1. One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anemostat Products; a Mestek company
 - 2. Carnes Company
 - 3. Carrier Corporation; a unit of United Technologies Corp.
 - 4. ENVIRO-TEC; by Johnson Controls, Inc
 - 5. Johnson Controls
 - 6. Krueger
 - 7. METALAIRE, Inc
 - 8. Nailor Industries Inc
 - 9. Price Industries
 - 10. Titus
 - 11. Trane
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- C. Casing: 22 gauge (0.034-inch) galvanized steel, single wall.
 - 1. Casing Liner: Comply with requirements in "Casing Liner" Article for flexible elastomeric duct liner.
 - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 - 3. Air Outlet: S-slip and drive connections for duct attachment.
 - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Volume Damper: 16 gauge (0.064-inch) thick galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
 2. Damper Position: Normally open.
- E. Attenuator Section: 22 gauge (0.034-inch) steel sheet.
1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for flexible elastomeric duct liner.
 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- F. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
- G. Direct Digital Controls: Control devices shall be compatible with temperature controls system specified in Section 230900 "Building Automation and Temperature Controls."
1. Factory installed controls furnished under Division 23, Section "Building Automation and Temperature Controls".
 2. The terminals shall be equipped with pressure independent controls which can be reset to modulate airflow between zero and the maximum cataloged cubic feet per minute. Maximum airflow limiters are not acceptable.
 3. The direct digital controls shall be supplied by the control contractor and mounted by the terminal unit manufacturer. Control contractor shall provide data sheets on all components to be mounted, indicating component dimensions, mounting hardware, and methods, as well as wiring and piping diagrams for each application identified by unit tag per the schedule in the drawings, to the terminal manufacturer.
 4. Controls shall be compatible with pneumatic inlet velocity sensors supplied by the terminal manufacturer. The sensor shall be multi-point center averaging type, with a minimum of four measuring ports parallel to the take-off point from the sensor. Sensors with measuring ports in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03 inch wg. at an inlet velocity of 500 fpm. The sensor must provide control signal accuracy of plus or minus five (5) percent with the same size inlet duct at any inlet condition.
 5. Controls shall be field set by control contractor for the scheduled minimum and maximum flow rates. Flow measuring taps and flow curves will be supplied with each terminal for field balancing airflow. All pneumatic tubing shall be UL listed fire retardant (FR) type. Each terminal shall be equipped with labeling showing unit location, size, minimum and maximum cubic feet per minute setpoints, damper fail position, and thermostat action.
 6. The terminal manufacturer shall provide a Class II 24 VAC transformer and disconnect switch. Actuator shall be direct connection shaft mount type without linkage. All controls shall be installed in approved NEMA type sheet metal enclosure by terminal manufacturer.

7. Box controllers with self calibration shall not interrupt flow.

H. Casing Liner

1. Casing Liner: The terminal casing shall be minimum 22-gauge galvanized steel, internally lined with a non-porous, sealed liner which complies with UL 181 and NFPA 90A. Insulation shall be 4 lb. density. All cut edges must be sealed from the airstream using mechanically bonded metal barrier strips. Liners made of Mylar, Tedlar, Silane or woven fiberglass cloth are not acceptable. Insulation shall be equivalent to TITUS Steri-Loc or double wall lining is acceptable. The casing shall be constructed to hold leakage to the maximum values shown in the Casing Leakage table.

I. Minimum Thickness: 3/4 inch.

1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
2. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

J. Source Quality Control

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.2 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7. Comply with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on air terminal units that are suspended with vibration isolators.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- F. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.3 TERMINAL UNIT INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. Unless otherwise indicated, air terminal units and associated controls shall be installed at a height no greater than 3 feet above a ceiling to allow maintenance accessibility.

3.4 CONNECTIONS

- A. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

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- B. Hot-Water Piping: Connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- C. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.
- D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.5 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.7 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - 3. Verify that controls and control enclosure are accessible.
 - 4. Verify that control connections are complete.
 - 5. Verify that nameplate and identification tag are visible.
 - 6. Verify that controls respond to inputs as specified.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

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END OF SECTION 233600

SECTION 233713.13 - AIR DEVICES

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. Registers, grilles and diffusers.

B. Related Requirements:

- 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

- 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
- 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

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

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. Ceiling suspension assembly members.
- 2. Method of attaching hangers to building structure.
- 3. Size and location of initial access modules for acoustical tile.
- 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- 5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 AIR DEVICES, GENERAL

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
 - 1. Anemostat Products; a Mestek company
 - 2. Carnes Company
 - 3. Krueger
 - 4. METALAIRE, Inc
 - 5. Nailor Industries Inc
 - 6. Price Industries
 - 7. Titus
 - 8. Tuttle & Bailey
- B. Provide air devices of the minimum sizes and quantities indicated and of the types specified.
- C. Contractor shall carefully study the drawings and the field conditions to ascertain the air device requirements as to suitability, location, air capacity, required accessories, border and finish.
- D. Border types shall be compatible with Architectural ceiling type for the room for which the air device is located. All devices shall have plaster frames when installed in plaster or drywall construction.
- E. Margins shall be as indicated or directed to suit field conditions.
- F. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
- G. Air devices shall be selected to provide draft-free air distribution over entire area served and sound rating shall not exceed Noise Criteria (NC) 25.
- H. Air device finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes.
 - 1. The pencil hardness must be HB to H.
 - 2. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film.
 - 3. The paint must pass a 250-hour ASTM D870 Water Immersion Test.
- I. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

2.2 TYPE A: LOUVERED FACE SUPPLY DIFFUSER, STEEL

- A. Ceiling diffusers shall be TITUS Model TDCA (steel) or approved equal for adjustable discharge pattern. These diffusers shall consist of an outer frame assembly of the sizes and mounting types shown on the plans and outlet schedule.

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- B. A square or rectangular inlet shall be an integral part of the frame assembly and a transition piece shall be available to facilitate attachment of round duct. An inner core assembly consisting of fixed deflection louvers shall be available in one-, two-, three- or four-way horizontal discharge patterns.
- C. Diffuser shall include adjustable vanes to provide full vertical projection as well as horizontal projection. The inner core assembly must be removable in the field without tools for easy installation, cleaning or damper adjustment.
- D. Opposed blade volume damper shall not be provided. Throw Reducing Vanes (TRV) must be available to deflect a horizontal discharge airstream from each side of the TDC diffuser into diverging airstreams.
- E. Molded insulation blanket shall be available. The insulation will be R-6, foil-backed, and provide an additional 1-inch gap around the neck to install insulated flex duct.
- F. The grille finish shall be #26 white.

2.3 TYPE B: PERFORATED RETURN/EXHAUST GRILLE, STEEL

- A. Perforated ceiling diffusers shall be TITUS model PAR (steel, flush face) or approved equal for return of the sizes and mounting types shown on the plans and outlet schedule.
- B. Diffusers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel. The backpan shall be one piece stamped heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule. The diffuser neck shall have 1 1/8-inch depth for easy duct connection.
- C. The perforated face must be easily unlatchable from the backpan.
- D. Optional opposed blade volume damper shall not be provided.
- E. The grille finish shall be #26 white.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install air devices level and plumb.

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- B. Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install air devices with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Paint the ductwork behind registers with flat black enamel so that bright surface cannot be seen. Properly prime galvanized surface prior to painting.

3.3 ADJUSTING

- A. After installation, adjust air devices to air patterns indicated, or as directed, before starting air balancing.
- B. The position of the pattern controllers for linear supply diffusers shall be verified and adjusted during Testing, Adjusting and Balancing.

END OF SECTION 233713

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. Alpha Wire.
 - 3. Belden Inc.
 - 4. Encore Wire Corporation.
 - 5. General Cable Technologies Corporation.
 - 6. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

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- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and XHHW.

2.2 METAL-CLAD CABLE, TYPE HCF-MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

- B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Alpha Wire Company.
2. American Bare Conductor.
3. Belden Inc.
4. Encore Wire Corporation.
5. General Cable Technologies Corporation.
6. Okonite Company (The).

- C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569, 83 and 1063.
3. Not all Type MC cable will comply with RoHS requirements, such as some types with galvanized-steel armor. Consult manufacturer.
4. RoHS compliant.
5. See the Evaluations for discussion of UL's "Wire and Cable Marking and Application Guide."
6. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

- D. Circuits:

1. Single circuit.

- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

- F. Ground Conductor: Insulated.

- G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

- H. Armor: Aluminum, interlocked.

2.3 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

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1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.
9. Tyco Electronics.

- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.4 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

- G. Branch Circuits Concealed in existing Walls and Partitions: Type HCF-MC cable.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

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3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL 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: Grounding systems and equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:

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1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL 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. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
- B. Related Sections include the following:
 - 1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.

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2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

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- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by IBC. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

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- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 260529

SECTION 260533 – RACEWAYS AND BOXES FOR ELECTRICAL 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. Metal conduits, tubing, and fittings.
2. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 260553 "Identification for Electrical Systems" for color coding of raceways and boxes.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

- a. Material: Steel.
- b. Type: compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

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- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell Company.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

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1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 5. Damp or Wet Locations: EMT.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Color code raceways and boxes per MUHA standards.
- G. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached. Provide support straps intended for this type of installation.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

- O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- Q. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- R. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- S. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- T. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - 3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

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- W. Label all box covers to indicate contents.
- X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Z. Locate boxes so that cover or plate will not span different building finishes.
- AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- CC. Set metal floor boxes level and flush with finished floor surface.
- DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- EE. For existing and new boxes in lead lined walls: coordinate with lead contractor to provide lead behind all boxes and conduit.

3.3 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.

END OF SECTION 260533

SECTION 260548 – VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL 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. This Section includes the following:

- 1. Isolation pads.
- 2. Spring isolators.
- 3. Restrained spring isolators.
- 4. Channel support systems.
- 5. Restraint cables.
- 6. Hanger rod stiffeners.
- 7. Anchorage bushings and washers.

- B. Related Sections include the following:

- 1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. See Structural Design Criteria on Drawing S001.
- B. Importance Factor: 1.5

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details 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 static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.
 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
 3. Field-fabricated supports.
 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- B. Qualification Data: For professional engineer.
- C. Welding certificates.

- D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant neoprene.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. [Amber/Booth Company, Inc.](#)
 2. [California Dynamics Corporation.](#)
 3. [Cooper B-Line, Inc.; a division of Cooper Industries.](#)
 4. [Hilti Inc.](#)
 5. [Loos & Co.; Seismic Earthquake Division.](#)
 6. [Mason Industries.](#)
 7. [TOLCO Incorporated; a brand of NIBCO INC.](#)
 8. [Unistrut; Tyco International, Ltd.](#)
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

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- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
 - 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL 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. Identification for raceways and boxes.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Fire Alarm – Red
 - 2. Life Safety – Yellow
 - 3. Critical – Orange
 - 4. Equipment – Green
 - 5. ATC/BAS – Blue
 - 6. Telecommunication – Brown
 - 7. Normal Power – no color
 - 8. Legend: Indicate voltage and system or service type.
- C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Colors for Cables Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

- B. Self-Adhesive, Self-Laminating Polyester Labels: Write-on, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.
- C. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.5 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.8 CABLE TIES

- A. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Coordinate color coding of conduit and exposed wire with Self Hospital standards.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power (all branches).
 - 2. Normal Power.
 - 3. Fire Alarm
 - 4. Telecomm
 - 5. ATC/BAS system
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service and feeder conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.

- 2) Phase B: Red.
 - 3) Phase C: Blue.
- c. Colors for 480/277-V Circuits:
- 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.
- E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.

- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

 2. Equipment to Be Labeled:
 - a. Panelboards. Also provide a typewritten directory of circuits in the location provided.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - e. Enclosed switches.
 - f. Enclosed circuit breakers.
 - g. Enclosed controllers.
 - h. Variable-speed controllers.

 3. All equipment that is labeled shall indicate equipment name and panel/circuit equipment is fed from.

END OF SECTION 260553

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. USB receptacles.
 - 3. GFCI receptacles, 125 V, 20 A.
 - 4. Hospital-grade receptacles, 125 V, 20 A.
 - 5. Toggle switches, 120/277 V, 20 A.
 - 6. Wall plates.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Device Color:
1. Wiring Devices Connected to Normal Power System: Ivory, to match existing hospital standard, unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Essential Electrical System: Red.
- F. Wall Plate Color: Brushed stainless steel to match existing hospital standard.
- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
 2. Description: Two pole, three wire, and self-grounding.
 3. Configuration: NEMA WD 6, Configuration 5-20R.

4. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.
5. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.3 USB RECEPTACLES

A. Tamper-Resistant Duplex and USB Charging Receptacles:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
3. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
4. USB Receptacles: Dual USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
5. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

B. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

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2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-15R.
4. Type: Feed through.
5. Standards: Comply with UL 498 and UL 943 Class A.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.5 HOSPITAL-GRADE RECEPTACLES, 125 V, 20 A

A. Hospital-Grade, Single Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

B. Hospital-Grade, Duplex Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

C. Hospital-Grade, Tamper-Resistant, Duplex Receptacles, 125 V, 20 A <drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. [Eaton \(Arrow Hart\).](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - c. [Leviton Manufacturing Co., Inc.](#)
 - d. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Standards: Comply with NEMA WD 1, UL 498 Supplement sd, and FS W-C-596.
 5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- D. Hospital-Grade, Tamper-Resistant, Duplex (125 V, 20 A) and USB Charging Receptacles:
1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [Eaton \(Arrow Hart\).](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - c. [Leviton Manufacturing Co., Inc.](#)
 - d. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
 2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
 3. Line Voltage Receptacles: Two pole, three wire, and self-grounding, NEMA Configuration 5-20R.
 4. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
 5. Standards: Comply with NEMA WD 1, UL 498 Supplement sd, UL 1310, and FS W-C-596.
 6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- E. Hospital-Grade, Duplex GFCI Receptacles, 125 V, 20 A:
1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [Eaton \(Arrow Hart\).](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - c. [Leviton Manufacturing Co., Inc.](#)
 - d. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
 2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Single-piece, rivetless, nickel-plated, all-brass grounding system.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Type: Feed through.
 5. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.

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6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

F. Hospital-Grade, Tamper-Resistant, Duplex GFCI Receptacles, 125 V, 20 A:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Single-piece, rivetless, nickel-plated, all-brass grounding system.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed through.
5. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

2.6 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A <Insert drawing designation>:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Standards: Comply with UL 20 and FS W-S-896.

B. Three-Way Switches, 120/277 V, 20 A <Insert drawing designation>:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Comply with UL 20 and FS W-S-896.

C. Four-Way Switches, 120/277 V, 20 A <Insert drawing designation>:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Standards: Comply with UL 20 and FS W-S-896.

2.7 DIMMERS

A. Wall-Box Dimmers:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
3. Control: Continuously adjustable slider; with single-pole or three-way switching.
4. Standards: Comply with UL 1472.
5. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.8 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: **0.035-inch-** thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide hospital grade devices in all areas except mechanical and electrical rooms and exterior areas. Provide hospital grade tamper proof receptacles in all public areas including but not limited to waiting rooms and lobbies.
- B. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- C. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- D. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- E. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than **6 inches** in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

F. Receptacle Orientation:

1. Match existing hospital standard.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

H. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black(normal) and red(emergency) -filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Tests for Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

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3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Test straight-blade hospital-grade outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than **4 oz.**
- E. Wiring device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 265100 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. LED lighting fixtures
 - 3. Exit signs.
 - 4. Lighting fixture supports.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast, including BF.
 - 4. Energy-efficiency data.
 - 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture

type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Lighting fixtures.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
 4. Structural members to which suspension systems for lighting fixtures will be attached.
 5. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Access panels.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.9 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 2 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- B. Special Warranty for LED Fixtures: Manufacturer's standard form in which manufacturer of LED light fixture agrees to repair or replace components of light fixture that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for LED Fixtures: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. LED Fixtures: Comply with UL 8750. Heat sink cooling without fans, pumps or moving parts.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. UV stabilized.
 2. Glass: Annealed crystal glass unless otherwise indicated.
- G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

2.3 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.4 DRIVERS/POWER SUPPLYS FOR LED

- A. Description: Self-contained power supply that has outputs matched to the electrical characteristics of the LED or array of LEDs.
 1. Driver compartment meets or exceeds IEC standard IP54.
 2. Located inside the housing with serviceable access for replacement.
 3. Housing or lenses constructed of polymers; must be UV stabilized.
 4. Must be current-regulated (deliver a consistent current over a range of load voltages).
 5. Designed for multi-current input operation.
 6. Must operate between -20°C and 50°C.
 7. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 8. Operating Frequency: 120 Hz or higher.
 9. Power Factor: 0.90 or higher.
 10. Dimming capability as described on drawings.

2.5 LEDES

- A. LED Module/Array: Designed for multi-current input operation.
- B. Light Quality: CRI 65 (minimum), color temperature 3500 K unless otherwise noted on the schedule.
- C. Minimum Lamp Life: L70 at 50,000 hours average rated life

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - 1. Install at least one independent support rod or wire from structure to a tab on lighting fixture for fixtures weighing less than 10 lbs. Install at least two independent support rods or wires from structure to a tab on lighting fixture for fixtures weighing more than 10 lbs but less than 56 lbs. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- E. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

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4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

3.4 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

END OF SECTION 265100

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS 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. Metal conduits and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 1. Structural members in paths of pathway groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

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- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. [AFC Cable Systems, Inc.](#)
 - 2. [Allied Tube & Conduit; a Tyco International Ltd. Co.](#)
 - 3. [Anamet Electrical, Inc.](#)
 - 4. [Electri-Flex Company.](#)
 - 5. [O-Z/Gedney; a brand of EGS Electrical Group.](#)
 - 6. [Picoma Industries; Subsidiary of Mueller Water Products, Inc.](#)
 - 7. [Republic Conduit.](#)
 - 8. [Robroy Industries.](#)
 - 9. [Southwire Company.](#)
 - 10. [Thomas & Betts Corporation.](#)
 - 11. [Western Tube and Conduit Corporation.](#)
 - 12. [Wheatland Tube Company; a division of John Maneely Company.](#)
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.

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- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression.
 - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. Hoffman; a Pentair company.
 - 6. Hubbell Incorporated; Killark Division.
 - 7. Lamson & Sessions; Carlon Electrical Products.
 - 8. Milbank Manufacturing Co.
 - 9. Molex; Woodhead Brand.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.
 - 12. RACO; a Hubbell company.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets:

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1. Comply with TIA-569-B.
 2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- I. Gangable boxes are not allowed.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed Conduit: IMC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Damp or Wet Locations: EMT.
 6. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 1-inch trade size. Minimum size for optical-fiber cables is 1 1/4 inch.

- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.
- H. Color code raceways and boxes per MUSC standards.

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, TIA-569-A and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to GRC before rising above floor.

- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- S. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- T. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- U. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where

environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- AA. Set metal floor boxes level and flush with finished floor surface.
- BB. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

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3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Notification appliances.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. An extension of the existing EST fire alarm system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals" Chapter in 2010 NFPA 72.
 - 2. Include voltage drop calculations for notification appliance circuits.
 - 3. Include battery-size calculations.
 - 4. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
 - 5. Include a sequence of operation, either in written or matrix format.
- C. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.

2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.

D. Delegated-Design Submittal: For annunciation devices. Provide layout per manufacture's recommendations. Provide ability to make field adjustments to suit environmental conditions for intelligibility. Show wattage of speakers in the shop drawing floor plans.

1. No change orders will be entertained unless the owner makes changes to the spaces.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:
 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in 2010 NFPA 72.
 2. Provide documents according to 2010 NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to 2010 NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without Owner's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide EST products.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. The system is existing and shall continue to operate as programmed.

2.3 FIRE-ALARM CONTROL UNIT

- 1. The fire alarm control unit is existing to remain. Expand as needed to accommodate new devices.

2.4 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate.
 - 1. Rated Light Output:
 - a. 15/30/75/110/177 cd, selectable in the field.
 - b. 177 cd for recovery room
 - 2. Mounting: Ceiling mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, white.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with 2010 NFPA 72 for installation of fire-alarm equipment.
- B. Connection to Existing Equipment: Verify that existing fire alarm system is operational before making changes and connections.
 - 1. Expand, modify, and supplement existing control equipment as necessary to extend existing control and monitoring functions to the new control panel. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- D. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

3.2 CONNECTIONS

- A. All fire alarm wiring shall be installed in rigid conduit painted red.

3.3 PROGRAMMING

- A. Coordinate room numbering with the Owner prior to programming the fire alarm system. Room numbers are not necessarily the ones shown on contract documents.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100.

3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by 2010 NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals " Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in 2010 NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in 2010 NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals " Chapter in 2010 NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in 2010 NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in 2010 NFPA 72. Use forms developed for initial tests and inspections.

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3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111